THURSDAY, FEBRUARY 26, 1880

THE SECOND YARKAND MISSION

The Scientific Results of the Second Yarkand Mission, based upon the Collections and Notes of the late Dr. F. Stoliczka. Published by Order of the Government of India. (Calcutta, 1878-79.)

BY the above publication the India Government and Dr. Stoliczka's scientific friends have raised a most enduring monument to the memory of one whose loss is still felt throughout the world of science. Born in Moravia in 1838, Ferdinand Stoliczka was destined by his father, a colonel in the Austrian army, for the Church; but, as better luck would have it, having taken his degree of Ph.D. in the University of Vienna, he at once obtained a post more in harmony with his tastes in the Vienna Geologische Reichsanstalt, where he laboured until 1862, when he was appointed by the late Prof. Oldham to the responsible position of palæontologist to the Geological Survey of India. His special work in the Survey will be to all time remembered. It forms four of the splendid volumes of the "Palæontologica Indica," all of which, with the exception of one paper by Mr. Blanford, are from the pen of Dr. Stoliczka. Although his chief fame will ever rest on his palæontological work, he was not unknown as a zoologist, and several important papers of his on living forms could be easily called to mind. Considering his age when snatched away from his work and friends, he had accomplished much, and had he lived, would surely have accomplished more. In Mr. V. Ball's recently published "Jungle Life in India" we get a glimpse of Stoliczka as the enthusiastic naturalist visiting the Nicobars. In July, 1873, a mission was sent to the Ameer of Káshghar and Yárkand, under the charge of Sir T. D. Forsyth. Starting from Murree in the Panjáb Hills on July 5, the mission to which Dr. Stoliczka was attached reached Leh, in Ladák, on August 27. After a halt of about a fortnight the journey was continued over the Sakti Pass to Lukong on the Pankong Lake. Yárkand was reached on November 8, and Káshghar on December 4. From Káshghar several excursions were made, Dr. Stoliczka visiting the Chadyr Lake just inside the Russian frontier, and proceeding at another time as far north-east as the Belowti Pass on the road to Ush Turfán.

A treaty was concluded with the Ameer on February 2, 1874, and much valuable information was collected regarding the present condition, resources, history, geography, and trade of the Yárkand and neighbouring countries. On the return Stoliczka was attached to Col. Gordon's party, which left Káshghar on March 17, 1874, reaching Yárkand after a *détour* on May 21, and leaving it on the 28th, when the mission party proceeded to recross the Kuenlun by a more western route than before over the Yangi Diwán, and then took the Kárákoram and Sháyok route to Leh. On June 16 Stoliczka complained of severe headache, with a feeling of oppression on the chest, in spite of which he the same day crossed the Kárákoram, making a collection of, and writing some notes in his diary about the Kárákoram stones. On the 17th he was no better. On the 18th, although suffering much, he climbed a hill to make some scientific exploration, and the effects of this exertion were at once visible. During the night of that day Col. Gordon ordered a halt for the next day. On the morning of the 19th he fell into a semi-comatose condition, from which he scarcely rallied, and he died a little after one o'clock on that day. Undue physical exertion at an extreme elevation and in a rarified atmosphere was the immediate cause of death. The remains were brought to Leh, where, in a corner of the compound of the British Joint Commissioner's residency they were laid with all honour on June 23, 1874. Over them, at the public expense, a suitable monument has been erected.

The scientific memoirs so far as they have reached this country, are as follows:—The Geology, by W. T. Blanford; the Mammalia, by W. T. Blanford; the Reptilia and Amphibia, by W. T. Blanford; the Pisces, by F. Day; the Hymenoptera, by Fred. Smith; the Neuroptera, by R. McLachlan; the Mollusca, by Geoffrey Nevill; the Syringosphæridæ, by Prof. Martin Duncan. Each of these forms a small folio part, beautifully printed at the Government Press, Calcutta, and excellently illustrated, often with highly-finished coloured drawings. All are based on the material collected during the expedition, and this was chiefly made by or under the direct superintendence of Stoliczka. Mr. Blanford complains that a considerable portion of the collection, including most of the finest specimens, was distributed with the consent of the Government, the greater portion becoming private property, and that the distribution was made with so little care, and with such a disregard of the interests of the Government and Dr. Stoliczka's memory, that even some specially prepared specimens were not to be found when looked for. Still withal the editors have done good and true service to Stoliczka's notes, Mr. Blanford and Mr. Day being helped thereto by their local knowledge.

Of the geological work accomplished Mr. Blanford writes that "very little indeed had been done to elucidate the geological structure of the country." But the results of Stoliczka's explorations during his first journey were very great. In the course of a single season's work in a most difficult country, amongst some of the highest mountains in the world, he clearly established the sequence of the formations, and from his extensive palæontological knowledge was able to do this with an accuracy which has stood the test of subsequent research. He, moreover, added to the list of known formations the representatives of rhætic and cretaceous rocks not previously detected, and showed that some of the other groups might be subdivided. The presence of this remarkable series of marine fossiliferous beds in the North-Western Himalayan region, a series in which all the principal European palæozoic and mesozoic groups, except the Cambrian, Devonian, Permian, and Neocomian are represented, is none the less surprising that scarcely any of the formations, except a few oolitic and cretaceous strata, are found in the peninsula of India beyond the Indus River basin. In the hills of the Panjáb some of the formations have been detected, but they were, until recently, very imperfectly known. In his second and last journey much work was also accomplished, but alas its full details will never be known. From the notes left behind him Mr. Blanford has collated what he could. "It is," he very truly says, "very difficult to do justice to a rough travelling diary such as Dr. Stoliczka

kept. In such a diary first impressions are very often recorded, and subsequent observations do not always show how far the first notes require modification. To the writer this is a simple matter; his notes are memoranda serving to recall details to his mind; but to another who does not possess the clue it is often very difficult to ascertain how far the notes in the diary agree with the final conclusions of the diarist." The sections illustrative of the geology of the country are from Dr. Stoliczka's note-book.

The account of the mammals, also from Mr. Blanford's pen, we are warned must only be considered as a contribution towards the zoology of the countries traversed. It is at present simply impossible to give anything like a complete list of the mammalia inhabiting Eastern Turkestan, the Pámir, and Wakhán. Even of Ladák, which is not only easy of access but is yearly frequented by English travellers and sportsmen, although the larger animals may be known, much more information will be necessary before a complete enumeration can be made. In this valuable contribution towards such a fauna Mr. Blanford describes, among the animals collected at Ladák, a lagomys, a mouse, a vole, and a shrew, which were previously unknown. The districts traversed by the second mission lay, with the exception of Kashmir, where a mixture of Indian (Oriental) forms is found, within the limits of the Palæarctic region; but they belong to different sub-provinces, distinguished chiefly by their physical characters, and especially by their elevation. Western Tibet or Ladák, in which may be included all the area north of Kashmir drained by the Indus and its tributaries, is a part of the high barren Tibetan plateau and the fauna comprises typically Alpine forms such as wild sheep and ibex, marmots and lagomys. The fauna inhabiting the ranges commonly known as the Kuenlun, intervening between the northern water-shed of the Indus and the low plains of Turkestan, is very similar to that of Tibet proper, but several species appear different. The animals of the plains of Eastern Turkestan around Yárkand and Káshghar belong to very distinct types, and appertain to the desert fauna of Central Asia, characterised especially by the abundance of rodents such as Gerbillus, Cricetus and Dipus. The few specimens of the mammals inhabiting the Thian Shan range, Pámir, and Wakhán, contained in Dr. Stoliczka's collection, are insufficient to give much idea of the fauna, as they were collected under great difficulties, during journeys when the ground was for the most part covered with thick snow. In drawing up this account Mr. Blanford has had the assistance of Dr. Dobson for the bats. It is illustrated by fifteen plates, several of which are coloured, in which all the new species are figured, with many osteological details.

The collection of reptiles made was small, partly owing to the country traversed not being rich in such forms of animal life, but still more perhaps because of the unfavourable season at which many of the excursions were made. The Thian Shan was visited in the depth of winter and the Pámir steppes and Wakhán long before the snow had melted, and under these circumstances no snakes, lizards, or other forms of reptilian life could be found. The bulk of the collection consisted of specimens procured on the journey from India to Káshghar in the Panjáb hills beyond Mari, in Kashmir and in Ladák and those obtained on the return journey between Yárkand an the Kárákoram. Of the lizards several new species are described and figured; of the amphibia only four species in all were collected. This memoir is by Mr. Blanford.

The account of the fishes obtained during the expedition is by Mr. Day. Twenty-five species are enumerated, several of which are described as new. After examining in detail the fishes of Yárkand and those of the adjoining countries, Mr. Day concludes, amongst other things, that there is to be found a peculiar group of carps (Schizothoracinæ) which has spread almost due east and west from the cold and elevated regions of Eastern Turkestan, but of which the southern progress has been barred by the Himalayas. If we look to the south we see, as it were, that a wave of tropical forms of fishes has at a prehistoric period expanded over that portion of the globe where the Nicobars, Andamans, and the most southern portions of the continent of Asia and the islands of the Malay Archipelago now are, that this fish fauna has its northward progress arrested by some cause at or near where the Himalayas now exist, and mark the division between the fish fauna of India and that of Turkestan.

The collection of Hymenoptera is described by the late Frederick Smith, of the British Museum. It contained sixty-three species, only nine of which appear to have been previously described; five new species are enumerated of that most cosmopolitan genus, Megachile; four new species of Bombus, and four of Formica. *Vespa germanica* was found at Sanju and in its neighbourhood also in Eastern Turkestan; eleven of the new species are beautifully figured from drawings by E. A. Smith.

The Neuroptera described by Mr. McLachlan were only fifteen in number: "four were species of Odonata (dragon-flies), one of Ephemeridæ, three of Perlidæ, one of Myrmeleonidæ, three of Chrysopidæ, and three of Trichoptera. The general aspect is European. All the dragon-flies are European, and two of them occur in Britain. The ant-lion (*Myrmecælurus punctulatus*) is a species of Eastern Europe." The three species of Trichoptera were new.

The Mollusca are described by Geoffrey Nevill. As was to be expected, "the fauna of Yárkand proves to be exceedingly poor in mollusca, and these are entirely European in their affinities. The fresh-water shells are indeed either identical with, or most closely allied to, well-known European forms." "The only striking novelty is the new *Succinea martensiana*, its thickness and opaqueness of texture, and its vivid orange-coloured aperture, make it one of the most interesting and peculiar forms of the genus." The characteristic Indo-Malayan genus, Nanina, disappears on the confines of Kashmir, but reappears in the Sarafshan Valley. About thirty species, several new, are described from Eastern Turkestan and Ladák, and twenty-five from Kashmir and the neighbourhood of Mari. The new species are all figured.

The last memoir on our list is a very interesting account of the Kárákoram stones by Prof. Martin Duncan; these are described as fossil rhizopods belonging to a new order called Syringosphærida, and containing but one family with two genera and six species. The second

genus is called after Stoliczka. This memoir is accompanied by three excellent plates.

Several other memoirs are expected ere this work will be complete. When finished, it will form a worthy monument to the memory of Ferdinand Stoliczka.

CRYPTOGAMIC FLORA OF SILESIA

Kryptogamen-Flora von Schlesien. Herausgegeben von Prof. Dr. Ferdinand Cohn. Zweiter Band, Erste Haelfte: Algen. Bearbeitet von Dr. Oskar Kirchner, und Zweite Haelfte: Flechten. Bearbeitet von Berthold Stein. (Breslau: J. U. Kern, 1878 and 1879.)

THE second volume of the "Cryptogamic Flora of Silesia," edited by Prof. Ferdinand Cohn, has now been completed in two parts. The first is devoted to the algæ, and the second to the lichens, the former having been worked out by Dr. Oskar Kirchner, while the latter part, on the lichens, is from the pen of Berthold Stein. The algæ of Silesia are, of course, fresh-water forms, and include a very fair proportion of all the species recognised as natives of Germany. Thus, reckoning the German algæ-flora at 1,688 species, the Silesian flora contains 794, or 47 per cent. Some of these have not yet been found out of Silesia, Kirchner giving a list of 40 species not yet detected elsewhere, and of these a considerable proportion are new species described for the first time in the present flora. Desmideæ, Diatomaceæ, and phycochromaceous forms furnish no less than 600 out of the total of 794 species, most of the others being Protococcoideæ and Confervoideæ, these numbering 88 and 86 species respectively, while the remainder is made up by 11 Florideæ, Batrachospermum and allies, and 6 Siphoneæ. The work may therefore be said chiefly to describe the Desmideæ and other Conjugatæ, 225 in number, the Bacillariaceæ (Diatomaceæ), 195, and the 185 Phycochromaceæ. The hypsometrical distribution of the species is carefully given, according to the plan adopted in the first volume, the whole country being divided into four regions. The first includes all land below the elevation of 150 metres, the second all elevations between 150 and 500 metres, the third from 500 to 1,100 metres, and the fourth from 1,100 to 1,500 metres. No less than 63 species, or 8 per cent. of the total number are met with in all the four regions, these species, however, being usually forms widely distributed in Europe. To the fourth or highest region there belong 16 special species out of a total of 104 in the whole region. The third or second highest district includes 131 species, or 16·5 per cent. of the whole, and of these 20 are special. The great majority of the species belong to the first and second regions, a distribution very different, as we shall presently see, from that of the lichens. The first or lowest region contains 472 species, or 59·5 per cent.; the second 612 species, or 77 per cent., while of these, 116 species are only found in the first, and 219 in the second, region. Lastly, it is found that the two regions together contain no fewer than 613 species not found at all in the higher districts.

A considerable part of the introduction is filled with a history of the study of Silesian algæ and of the gradual progress made by different workers in the elucidation of the species and localities. Then follows a long and excellent account of the anatomy and reproduction of the algæ, which are here defined as chlorophyll-bearing cellular plants not differentiated into stem and leaves. The unicellular and the multicellular thallus is then described, and the various gradations noticed among the unicellular forms, from the spherical Protococcus up to the highly differentiated unicellular Caulerpa, the forms of the multicellular thallus being treated in the same way. Paragraphs are devoted to the cell, cell-wall, cell-contents, and to the different colouring matters contained in the cells of the different groups. The modes of reproduction, non-sexual and sexual, to be observed in the algæ are fully described. As might be expected in a flora, Dr. Kirchner does not employ the subdivisions of the Thallophytes as defined by Sachs, although he fully recognises and points out the affinities exhibited by many chlorophyllaceous and colourless Thallophytes. The algæ, therefore, are considered as a special class, and are subdivided for the purposes of this flora into six orders and into sixteen families. The orders are Florideæ, Confervoideæ, Siphoneæ, Protococcoideæ, Zygosporeæ, Schizosporeæ. The Protococcoideæ are made to include as families the Volvocaceæ, Protococcaceæ, and Palmellaceæ, while the Zygosporeæ include the families Conjugateæ and Bacillariaceæ. Lastly the order Schizosporeæ includes the Nostocaceæ, with five subdivisions, Rivularieæ, Scytonemeæ, &c., and the Chroococcaceæ.

Under the different families the genera and species are fully described, and apparently in a manner well calculated to render the work extremely useful to all botanical students.

The second half of the second volume contains the Lichens, by Berthold Stein. The general treatment of the subject is the same as that already mentioned in the case of the algæ. The introduction, giving an historical account of the progress of Silesian lichenology, the hypsometrical distribution of the species, and then an account of the anatomy and reproduction of lichens. Stein, as might be expected, is an opponent of Schwendener's lichen theory, and bases his objection on the ground that many observations have shown that the first gonidia of the lichen are developed by division or budding from certain side branches of the lichen hyphæ, in a manner probably somewhat similar to the formation of the new cells of Saccharomyces. This alleged fact, which he does not support by any reference to his own observations or to those of other botanists, he considers of itself renders the whole of the Schwendener-Bornet theory untenable.

The Silesian lichens include 705 species belonging to 158 genera. The main feature in regard to the genera being the reduction of Lecidea and Lecanora, to comparatively limited dimensions by the adoption of many new genera. The distribution of the Silesian lichens, according to Stein, confirms the statement that lichens are the "Children of the Air and of the Light," most of them inhabiting the higher parts of Silesia in regions three and four. Common to all the four regions are 76 species, or 11 per cent. of the total given by Stein of 678 species in the introduction, although the description gives 705 consecutive numbers. The first region contains 84 species, of which only 8 are peculiar to it. The second region contains 281 species, or about 41 per cent. of the whole, 115, or 17 per cent. being limited to it. The third

region contains 405 species, or 60 per cent., and of these 82, or 12 per cent., are special. Lastly, the fourth region contains 291 species, or 42 per cent., and of these 126, or 18 per cent. are found in it only. No fewer than 18 of these are found in the basalt of the lesser Schneegrube, which Stein calls the "El Dorado of Lichenologists," as 16 of them are not met with elsewhere.

Stein defines lichens as being those thallophytes in which the thallus exhibits a union of gonidia, threads or hyphæ and chlorophyll-bearing, or phycochromaceous cells, or gonidia, the fruit-body containing the spores in asci. The structure of the thallus is described in full, as well as that of the reproductive organs, the spermogonia and apothecia. Spermogonia, now recognised as the male reproductive organs, have been met with in most lichens, but are as yet unknown in the genera Solorina, Myriangium, and Siphula. Usually spermogones and apothecia occur in the same plant, lichens being thus mostly monœcious, but occasionally the two kinds of organs are on different plants, as in *Ephebe pubescens*, which is diœcious. The origin of the apothecium from the ascogonium and carpogonium is described from the observations of Stahl, and the non-sexual reproduction by the pycnides with their stylospores or conidia, is also mentioned, while the formation of soredia is described as spontaneous division of the thallus. Most lichens produce soredia, and we may form a new plant, or several may unite together to form a single new thallus. The structure of the gymnocarpic apothecium with its four layers, the hymenium, sub-hymenium, hypothecium and excipulum, is detailed in full.

The division of the lichens into subordinate group calls for no remark, while to assist the student a very good analytical key to the genera is given, occupying no less than seven pages. In the description of the species the chemical reactions are given, but Stein seems very wisely to reject all species *only* recognisable by chemical tests, *i.e.*, without some structural character.

W. R. McNab

OUR BOOK SHELF

Blowpipe Analysis. By J. Landauer. Authorised English Edition, by James Taylor and William E. Kay. (London: Macmillan and Co., 1879.)

The writer of this treatise, as appears from his preface, has designedly restricted its scope by omitting all reactions peculiar to minerals, on the ground that most works already in existence upon the subject treat the mineralogical part in great detail, and devote comparatively little attention to its chemical aspects. This resolution is unfortunate, as the principal justification for the systematic teaching of blowpipe analysis is to be found in the facility thereby acquired in the identification of the constituents of minerals by simple means when the resources of a complete laboratory are not at hand; and by omitting all characteristic mineral reactions the interest of the work is decidedly lessened. Within these restricted limits, however, the book is a very good one and likely to be useful to students in chemical laboratories as an adjunct to the ordinary text-books on analysis, and this utility will be increased by the chapter on Bunsen's flame reactions, which have for many purposes replaced the older methods of investigation. The matter is condensed in a fashion rather unusual in works of German origin, and the arrangement is good though somewhat troublesome to use, on account of the adoption of a double system of numeration by pages and paragraphs. Neither author nor translators have, however, paid sufficient attention to the necessity, or at any rate desirability, of properly proportioning the different parts of the blowpipe. In this respect the examples figured are to be avoided, as they are far too narrow in the tube to be used with anything like comfort. We should also be disposed to give the first instead of the second place to the Plattner oil-lamp when compared with the gas-flame. The latter is undoubtedly more convenient, as saving the trouble of trimming and cleaning; but for all accurate work a good lamp or even a candle flame is generally preferable as being more readily controlled than gas. A self-acting blowpipe on the principle of the Sommellier compressor made with two bottles, a length flexible tube, and a gallon of water described on p. 5, deserves notice for its ingenuity, but such contrivances are not to be recommended in practice, for they are, to quote the words of a leading American mineralogist, "unnecessary when the student has sufficient enterprise to learn to blow the ordinary instruments, and no others will be likely to make much progress in blowpipe analysis."

The Zoological Record for 1877; *being Volume Fourteenth of the Record of Zoological Literature.* Edited by E. C. Rye, F.Z.S. (London: Van Voorst, 1879.)

It is now just fifteen years ago since the project of the *Zoological Record* was first started by Dr. Günther. The difficulties of the undertaking were many, the labour was great, the reward uncertain. It would seem a proof, however, of there being a necessity for such a publication when we find it still pursuing the even tenour of its way, under the auspices at present of an association, and favoured by considerable money grants from the Royal Society, the British Association, and the Zoological Society of London. The original staff of recorders have now all but Dr. von Martens ceased from their recording labours and a younger generation takes their place.

The pagination is now, we observe, of a new, perhaps of a more scientific, but certainly of a puzzling type, each class having a pagination to itself, so that the sequence of the classes has first to be learnt and then only can one find the object looked for; that this may be a convenience to the printer we acknowledge, but we do not think it a commendable plan. We confess too that we like the method still adopted by some of the older recorders, of giving first a list of the more important publications in a group, then an account of the works on the anatomy and embryology of the same, next the contributions to faunas, and lastly, the new forms, &c., under their orders and families. To say the least the editor would consult the convenience of the student if he would suggest an uniformity in practise in these particulars to his staff. Thus making all due allowance for the difficulties in the way of classifying the Vermes, yet the manner in which the new genera and species are recorded makes it rather difficult to find out what has been done in this group during 1877. The editor too, for he alone could do it, might have added to the last paragraph but one treating of the worms, a reference to "Moll. 55," where pretty much the same facts are stated as we find recorded in "Verm. 21." Amid such a quantity of matter it would be simply an impossibility that mistakes should not sometimes occur, and indeed on a careful survey of this volume such have very rarely turned up. In "Ech. 5" we may remark that the notes by "G. McIntosh" referred to should be credited to H. W. Mackintosh, probably not even a relation of the person named. In "Cœl. 13" is not *Cylicozoa* a misprint for Calycozoa? At "4 Spong." we read, "Gen. *Ceratella*, Gray, and *Dihitella*, Gray, are undoubtedly the same genus, *C. labyrinthica*, sp.n. (*vide infrà*)" (why is the accent always on this *a*). We have looked both below and

above and yet have found nothing more about this new species. Has not H. B. Brady's paper, "On some Foraminifera from the Loochoo Islands" (*Proc.* R.I.Ac., vol. ii. n.s. p. 589) been overlooked by the recorder of the Protozoa? Perhaps Ross, F. O., "Myology of the Cheetah" (*Felis jubata*), in the same *Proceedings*, vol. iii. n.s., part 3, August, 1877, was also worthy of a reference. Other papers are quoted from these same *Proceedings*, which it is true contain little that is zoological. Without a wish to start a controversy as to the reproducing the Greek κ by the English *c*, we venture to think that a little discretion might be allowed to authors in this matter.

In concluding this notice we thank, in common with all zoologists, the editor for the volume he has published, and we wish a long and prosperous life to the association of which he is the officer, an association which deserves every possible assistance from those interested in the subject of zoology.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Sunshine Cycles

PROF. PIAZZI SMYTH in his letter headed as above to NATURE (vol. xxi. p. 248) has given us the latest information regarding those variations of temperature indicated by the Edinburgh earth thermometers, commonly termed "waves of heat and cold." He has, however, cited but one case in which an extraordinary amount of sunshine was actually observed to occur simultaneously with the crest of a heat-wave, viz., in 1826.

Having lately been engaged upon a comparison of the annual and seasonal amounts of cloud in different parts of Europe, I think I can bring forward some evidence to show that these waves of heat and cold are indeed veritable cycles of sunshine and gloom.

Before proceeding to give proofs of this statement, however, it will be necessary to consider for a few moments the effects that most probably attend a prevalence of cloud or the reverse at different seasons of the year. It is, I imagine, pretty generally allowed that presence of cloud in the summer is associated with coolness and in the winter with warmth; and in like manner that clear skies which in the summer by promoting solar radiation favour the development of great heat, in the winter by giving free scope to terrestrial radiation (in the then comparatively reduced stage of solar radiation) tend to produce excessive cold.

A warm year need not therefore be a *very* cloudless year, provided the majority of its cloud occurs during the cooler months. In like manner a cold year need not be *very* cloudy, provided its clear sunshiny days occur mostly in the winter, or when the solar altitude is small.

It must, however, be noted that the effects of the presence or absence of cloud are not of equal *magnitude* at the summer and winter solstices respectively. At and near the former epoch the temperature of the extra-tropics is more dependent on the direct solar rays, and anything which intercepts these produces a more marked effect than at the latter epoch, when the prevailing direction of the wind becomes the predominating factor.

If, then, any general relation with respect to cloudiness be visible in the mean annual results, at the epochs of greatest heat and cold as given by Prof. Smyth, the results for the summer seasons alone, should exhibit the *same* relation but in a more marked degree.

The following tables have been prepared from the limited data at my disposal, with especial reference to the foregoing considerations.

They comprise the following observations:—

1. The relative monthly and annual mean cloud proportions at Greenwich from 1841 to 1876, and at Oxford from 1850 to 1875, as supplied to me by Mr. Whipple, of the Kew Observatory.

2. Do. at Munich from 1843 to 1866, as summarised by Dr. J. Lamont in the "Monatliche und jährliche Resultate der an der königlichen Sternwarte bei München von 1843 bis 1866 angestellten meteorologischen Beobachtungen."

3. Do. at Breslau, as given by Dr. J. Galle in a similar work.

4. The results of the tri-daily observations at Leipzig from 1830 to 1859, and for the summer months at Münster from 1858 to 1874 ("Ueber die Beziehungen der Sonnenfleckenperiode zu meteorologischen Erscheinungen," von Dr. F. G. Hahn. Leipzig, 1877, pp. 123-126).

5. The annual number of cloudy days (giorni nuvoli) at Bologna from 1814 to 1858 ("Notizie sul clima Bolognese, etc., nel quaranta cinquennio 1814-1858," by Prof. L. Respighi).

6. The number of days on which Schwabe was unable to observe the sun at Dessau in each year, from 1826 to 1859.

7. The number of days on which neither Prof. Wolf nor his assistant could observe the sun at Zurich from 1859 to 1877 ("Ueber die Beziehungen der Sonnenfleckenperiode zu den met. und mag. Erscheinungen der Erde," von H. Fritz. Haarlem, 1878, p. 212).

The figures in every case denote the difference from the corresponding mean, but those for Greenwich, Oxford, Munich, and Breslau only, are intercomparable.[1]

TABLE I.—*Mean Annual Cloud.*

Piazzi Smyth's dates for the crests of heat-waves.	Years.	Greenwich.	Oxford.	Munich.	Breslau.	Bologna. (diff. from yearly mean.)	Leipzig. (diff. from yearly mean.)
1826·5	1826	—	—	—	—	− 2	—
1834·5	1834	—	—	—	—	− 38	− 78
1846·4	1846	+0·2	—	−0·43	—	+ 18	− 21
1857·9	1857	−0·1	−0·2	−0·03	−0·8	− 5	− 151
1868·8	1868	−0·6	−0·2	—	−0·1	—	—
Means ...	...	−0·1	−0·2	−0·25	−0·4	− 6	− 83
Dates for the crests of cold-waves.							
1829·6	1829	—	—	—	—	+ 8	+ 45
1837·3	1837	—	—	—	—	− 17	+ 37
1845·2	1845	−0·1	—	+0·10	—	+ 10	+ 9
1848·0	1848	+0·2	—	−0·23	—	+ 8	+ 16
1855·8	1855	+0·3	+0·2	+0·50	±0·0	+ 13	+ 2
1860·3	1860	+0·6	+0·7	+0·70	+0·6	—	—
1866·3	1866	+0·3	±0·0	−0·10	+0·1	—	—
1870·3	1870	−0·6	−0·5	—	±0·0	—	—
1879·1	—	—	—	—	—	—	—
Means ...	...	+0·1	+0·1	+0·1	+0·1	+ 5	+ 21

TABLE II.—*Summer Cloud.*

Years.	Greenwich.	Oxford.	Munich.	Breslau.	Leipzig.	Münster.
1826	—	—	—	—	—	—
1834	—	—	—	—	− 16	—
1846	−0·38	—	−1·35	−0·8	− 15	—
1857	−1·08	−0·75	−0·70	−0·5	− 25	—
1868	−1·45	−0·95	—	—	—	− 18
Means	−0·97	−0·85	−1·07	−0·6	− 18	− 18
1829	—	—	—	—	+ 21	—
1837	—	—	—	—	− 3	—
1845	−0·25	—	+0·25	—	− 3	—
1848	+0·59	—	±0·0	—	+ 21	—
1855	−0·28	+0·41	+0·15	+0·1	− 2	—
1860	+1·45	+1·71	+0·68	+0·9	—	+ 14
1866	+0·49	+0·38	+0·38	+0·8	—	+ 1
1870	−0·31	−0·62	—	+0·4	—	+ 9
Means	+0·28	+0·47	+0·29	+0·55	+ 6	+ 8

[1] Those for Munich and Breslau originally given on the scale of 0–4 have been converted to the ordinary scale of 0–10.

TABLE III.—*Winter Cloud.*

Years.	Greenwich.	Oxford.	Munich.	Breslau.	Sums.
1826	—	—	—	—	—
1834	—	—	—	—	—
1846	+0·12	—	−0·03	—	+0·09
1857	+0·12	−0·34	−0·53	−1·27	−2·02
1868	+0·17	+0·46	—	+0·45	+1·08
Means	+0·13	+0·03	−0·28	−0·41	—
1829	—	—	—	—	—
1837	—	—	—	—	—
1845	−0·05	—	+0·17	—	+0·12
1848	+0·25	—	−0·58	—	−0·33
1855	+0·52	+0·13	+0·47	−0·02	+1·10
1860	±0·0	+0·21	+0·52	+0·75	+1·48
1866	−0·25	−0·54	−0·33	+0·10	−1·02
1870	−0·28	−0·04	—	−0·17	−0·49
Means	+0·03	−0·06	+0·05	+0·14	—

TABLE IV.—*Number of Days on which Schwabe was unable to observe the Sun at Dessau.*

Years.		Days.	Years.		Days.
1826	... ...	88	1843	... ...	41
27	... ...	92	44	... ...	46
28	... ...	84	45	... ...	33
29	Cold wave	121	46	Hot wave	51
30	... ...	148	47	... ...	89
31	... ...	126	48	Cold wave	88
32	... ...	96	49	... ...	80
33	... ...	98	50	... ...	57
34	Hot wave	92	51	... ...	57
35	... ...	121	52	... ...	29
36	... ...	166	53	... ...	66
37	Cold wave	197	54	... ...	31
38	... ...	163	55	... ...	52
39	... ...	160	56	... ...	45
40	... ...	103	57	... ...	41
41	... ...	82	58	Hot wave	30
42	... ...	58	59	... ...	22

Days on which neither Prof. Wolf nor his Assistant could observe the Sun at Zurich.

Years.		Days.	Years.		Days.
1860	Cold wave	92	1869	... ...	101
61	... ...	81	70	Cold wave	89
62	... ...	76	71	... ...	93
63	... ...	90	72	... ...	71
64	... ...	74	73	... ...	62
65	... ...	69	74	... ...	62
66	... ...	67	75	... ...	86
67	... ...	66	76	... ...	89
68	Hot wave	92	77	... ...	58

So far as the preceding tables afford a basis for deduction, it appears that with few exceptions (1) the annual amount of cloud is *below* the mean at the epochs of the crests of the heat-waves, and *above* the same at those of the cold-waves; (2) that the relation is of the same kind, but more marked when the results for the summer season alone are compared; (3) that the results for the winter show in several cases a tendency to vary in the opposite manner.[1]

I may remark that in general the dates of the crests of the hot and cold waves, as given by Prof. Smyth, coincide with, and include, the principal critical epochs of the cloud variation.

Judging from the cloud observations *alone*, the most intense, as well as most universal waves would seem to have been the hot waves of 1857 and 1868, and the cold wave of 1860.[2]

It would be premature to attempt to draw any definite conclusions from the results I have exhibited, but they rather tend, I think, to dissipate the notion Prof. Smyth apparently entertains, that there is any specific difference between the waves of heat and those of cold.

It would seem indeed as though *both* were partially dependent upon watery vapour and its transformations, the heat wave being in part the *effect* of an excess of sunshine, and the cold wave of an excess of cloud.

Again, were the heat waves of more direct cosmical origin than the cold waves, they should occur more universally and more simultaneously in different parts of the world than the latter, whereas the results of most investigations into this matter point the other way. The epochs of maximum and minimum annual temperature may be respectively nearly identical for as large a district as that included by the stations employed above, but they certainly differ to some considerable extent, though at the same time in a regular and progressive manner, when the observations are made to embrace an entire hemisphere.

Thus, according to Köppen, the following are the dates of maximum and minimum air-temperature in the tropics and extra-tropics respectively:—

Köppen's epochs of maximum air-temperature. Tropics.	Extra tropics.	Piazzi Smyth's epochs of crests of heat-waves.	Wolf's dates for minimum sun-spots.
1822·5	1825·8	1826·5	1823·3
1833·1	1834·2	1834·5	1833·9
1842·8	1846·4	1846·4	1843·5
1854·7	—	1857·9	1856·0
1865·1[1]	(1868·7)	1868·8	1867·2

Köppen's epochs of minimum air-temperature. Tropics.	Extra-tropics.	Piazzi Smyth's epochs of crests of cold-waves.	Wolf's dates for maximum sun-spots.
1830·1	1831·9	1829·6	1829·9
1836·4	1837·8	1837·3	1837·2
		1845·2	
1847·6	1850·3	1848·0	1848·1
		1855·8	
1858·4	(1861·6)	1860·3	1860·1

From the above table it is evident that *both* the heat and cold waves are retarded in the extra-tropics behind those in the tropics, the mean lag being as much as 2·9 years in the case of the former and 2·2 years in that of the latter. There is no reason, therefore, for supposing either of these phenomena in the extra-tropics to be the *direct* effects of solar or cosmical influences; but, on the contrary, there is much to favour the notion that they are both equally the indirect consequences of the corresponding elevations and depressions of temperature in the tropics.

It will be noticed that while the crests of both the hot and cold waves given by Prof. Smyth agree in the majority of cases with those given by Dr. Köppen for the extra-tropics and also with the sun-spot epochs, there are one or two cold waves, such as those of 1845, 1855, and 1866, which appear completely isolated from either of these latter, though I am not aware that they are inferior to the rest in point of magnitude. That even these waves are not of mere local occurrence, though their prototypes do not appear in the tropics, is probable, from the fact that similar ones have been noticed by Dr. F. G. Hahn to occur at Leipzig in 1845, 1855, and 1865, in the form of secondary maxima of cold corresponding to the secondary maxima in the aurora.

In the short cycle 1829-37 no secondary wave appears at Leipzig just as at Edinburgh.

Meanwhile, whatever causes be ultimately adduced to account for the appearance of these periodical waves of heat and cold, it is evident that they partially bear out the designation accorded them by Prof. Smyth, of "sunshine cycles."

February 3 E. DOUGLAS ARCHIBALD

[1] As a further addition to the evidence just given, both in favour of the secular variation and the contrary character of the two extreme seasons as to cloud, Prof. Piazzi Smyth tells me that the results of the cloud observations at Edinburgh for eighteen years show June and July, 1879 (the date of the most recent cold-wave), to have been the cloudiest months throughout the period, but December, 1879, the clearest, the year on the whole being excessively cloudy. On the other hand June and July, 1868 (a heat-wave), were the clearest ever known.

[2] It is somewhat remarkable that in Dr. Köppen's great work on the temperatures in different parts of the globe in connection with the sun-spot period, the heat-wave of 1857, as deduced from air-temperatures, appears only as a local phenomenon in the extra-tropics. The other dates, 1825·8, 1834·2, 1846·4, and 1868·7, given by Dr Köppen for the maxima of the temperature of the extra-tropics are nearly identical with those deduced from the earth-temperatures by Prof. Smyth.

[1] This epoch is given by Prof. S. A. Hill, of Allahabad, in continuation of Dr. Köppen's work, and is deduced from observations taken in India (see "Variations of the Rainfall in Northern India," by S. A. Hill, *Indian Meteorological Memoirs*, p. 193). Great reliance cannot therefore be given to it, though at the same time it agrees very well with the result for the *sub*-tropics, as given by Dr. Köppen.

The "Gastric Mill" of the Crayfish

FOR demonstrating the structure and action of the elaborate gizzard of the crayfish, which I have found to be usually regarded as a hopeless puzzle, I have constructed, in Prof. Lankester's laboratory at University College, at his suggestion and for the use of his class of practical zoology, a little model, the simplicity of which enables any student to construct one for himself, and thus thoroughly to apprehend the mechanical significance of the apparatus found in the crustacean.

A description of it will be useful to some of your readers.

Out of a sheet of good cardboard cut a piece having the shape represented in Fig. 1. Along the lines marked *a b*, *c d*, *e f*, *h i*, *m n*, draw a penknife so as to slightly cut into the cardboard, and on the *opposite face* of the cardboard make similar cuts along the lines *g h*, *k l*. Now bend the outstanding pieces, 2, 2, a very little downwards, so that they stand at a slight angle to the piece 1.

Revolve the pieces 9 downwards upon the hinge lines *a b*, until each of them is brought into the same plane again as the piece 6, 5, 6. Fasten, by either gum or a knotted thread, the lower or unseen surface of the shaded bit of 9 flat against the lower face of the piece 6, 5, 6. Then bend the unshaded portion of each of the pieces 9, into a plane at right angles with the shaded portion, using the dotted line, *k l*, as hinge. These upstanding pieces 9, 9 represent the lateral teeth.

Now apply gum or a needle and thread to the shaded piece between 3 and 4, bending the whole piece 1, 3, 4, upon the hinge-line *g h*, until the shaded bit lies flat upon the surface of 4, to which it is to be securely joined. Bend back the piece 1, 3, using *e f* as hinge, until it lies in a plane at right angles to that of 4. The projecting termination of 4, as the

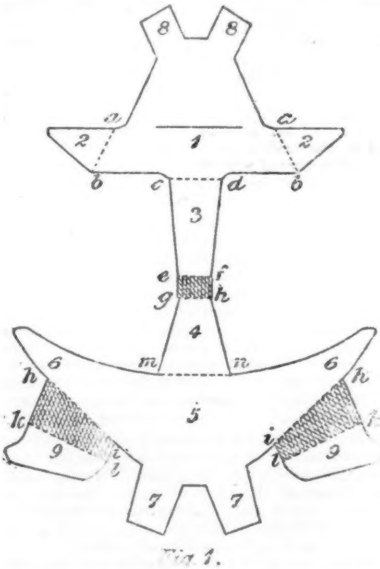


Fig. 1.

Cardboard as cut.

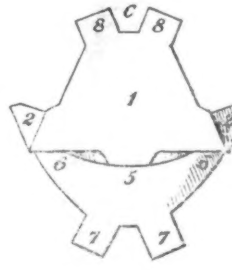


Fig. 2.

The apparatus complete: at rest.

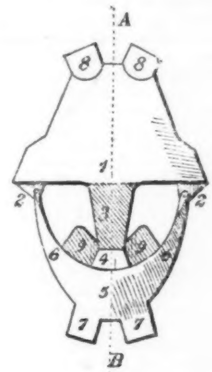


Fig. 3.

The apparatus complete: in a state of tension.

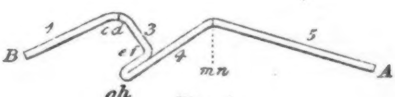


Fig. 4.

pieces are now bent and fastened, represents the central tooth of the gastric mill. Now bend 1 a little downwards upon 3, using *c d* as hinge, and bend 4 upon 5 very much, using *m n* as hinge. Finally, by means of thread or of fine wire, join the perforated corner of the pieces 6, 6, to the corresponding perforated corners of the pieces 2, 2, right to right and left to left, in such a way that the pieces 2, 2 lie outside the pieces 6, 6, and let the joint consist only of a single thread or wire, which may act as a pivot for rotation. In order to effect the joining of these pieces, the piece 6, 5, 6 will have to be bent like a bow, its right and left arms being deflected downwards and inwards.

The model is now complete. 1 represents the cardiac ossicle or sclerite; 2, 2, the two pterocardiacs; 3, the urocardiac; 4, the prepyloric; the shaded bit, together with the piece to which it has been affixed, now represents the median tooth, and projects downwards and forwards; 5, the pyloric sclerite; 6, 6, the right and left zygocardiacs; whilst 9, 9 represent the horizontally placed lateral teeth. The anterior and posterior processes, 8, 8 and 7, 7, represent respectively the anterior and posterior gastric muscles which are affixed in the position indicated and to the firm wall of the carapace. If we now pull upon these pieces so as to represent the effect of a muscular contraction, we shall find that the three teeth come together with a clash, but are again separated and the whole apparatus brought to its original condition by the elasticity of the cardboard. Again and again the clashing of the teeth can be effected by the tension applied at 8 and 9, just as it is in the living crayfish. If the parts representing the three teeth be very carefully adjusted as to size and direction, and be covered with some hard substance, such as sealing-wax (applied after solution in spirit), they may be made really to grind soft substances, such as bread, into fragments.

W. E. ROTH

University College, Gower Street, February 4

Modern Chromatics

IN NATURE, vol. xxi. p. 78, is a review of a book of mine, "Modern Chromatics," by Silvanus P. Thompson, that contains one or two points that I ought perhaps not to allow to pass without notice. The statement is made by the reviewer that I claim as mine a certain experiment which was originally described in England by T. Rose. I find, however, on examination, that Mr. Rose read his paper on this subject before the British Association in 1861, while mine was published in September, 1860, in the *American Journal of Science and Arts*. In the same review it also stated or implied that I am in error in saying that in blue eyes there is no real blue colouring matter, but that the blue hue is due to the presence of a turbid (or opalescent) medium. Essentially the same statement with details will be found on p. 14 of Helmholtz's "Physiological Optics," also on p. 610 of Dalton's "Human Physiology." In his "Physiologie der Farben," on p. 95, Brücke remarks:—"In the most beautiful blue eye there is no trace of any blue colouring matter."

If any real blue pigment has been discovered in the iris of the human eye, it would interest me to know when and by whom.

The reviewer also intimates that I am in error in stating that

the colours displayed by the photographs obtained by Becquerel and other earlier experimenters from coloured objects, were due merely to the interference of the rays of light reflected from the plates, that is, were the colours of turbid media. The conclusion reached by me was based on a repetition in 1853 of Becquerel's experiments, on a personal examination of two of the coloured photographs of Nièpce, and on the results obtained by C. Schultz-Sellack, *Pogg. Ann.* for 1871, p. 449; and finally, in a more general way, on a prolonged photographic experience in which colours were not unfrequently obtained by myself that imitated those of nature, but were really due to the interference of light. OGDEN N. ROOD

New York, January

[It is a matter of regret that Prof. Rood should misunderstand the entire tone of a passage which occurs in my review of his admirable work on "Modern Chromatics." In the passage referred to I stated that there were one or two points which would be better revised whenever a second edition should be called for: these being statements set down without any qualification whatsoever, but which are not universally accepted, and which, as being still matters not removed from the field of controversy, should not be stated without reserve in a text-book where space forbids discussion or extended reference. There are physiologists who do not accept without some qualification Helmholtz's statement that the blue tint of eyes is simply due to turbidity of the medium. The most eminent authorities on the subject in this country do not accept the view that the beautiful photographs in colours obtained by Becquerel and others are *merely* due to interference of light, in fact their opinion is the very reverse. Hence, while the sentence to which I have taken exception may be regarded as Prof. Rood's *opinion*, it cannot be regarded as a universally accepted view; and that is all I have desired to intimate.

As to the experiment with the rotating disk claimed by Prof. Rood, there is no doubt whatever that he has the *priority*. It is, however, literally true that the experiment, which Prof. Rood claims (and rightly claims) as his own, was originally described in England by Mr. T. Rose in 1861. Nothing was further from the writer's intention than to charge Prof. Rood with plagiarism for describing the same experiment in America in 1860.—S. P. T.]

Etna

PROF. O. SILVESTRI writes me in a letter dated Catania, February 12:—"L'Etna dal 10 Febbrajo presenta fenomeni eruttivi dentro al cratere centrale e ci ha dato una pioggia di cenere che ha ricoperto tutta la neve sul fianco Est-Sud-Est." Some of the ash inclosed in the letter is grey in colour, exactly like pulverised basalt. Under a high power it is seen to consist of minute transparent tabular crystals (probably felspar), mixed with greenish and brownish particles. The mud craters near Paterno have lately exhibited increased activity, and slight shocks of earthquake have been felt on the north-east and south-west sides of the mountain. G. F. RODWELL

February 23

Ice-Crystals and Filaments

IF the Duke of Argyll will look again at the second of the three letters in NATURE, vol. xxi. p. 302, he will see that, although my explanation of the ice-filaments agrees on the whole with those contained in the other two, it differs in one important respect, and is not liable to the chief objection which he alleges against the theory. I suppose the crystallisation of the water to go on *pari passu* with its exudation at the surface of the rotten wood. If the wood be saturated with water the water will begin to exude by expansion as soon as its temperature falls below 4° C., that is, before it becomes frozen. Now the temperature at the surface will fall more rapidly by radiation than that within by conduction. Consequently the water will for the first time be subjected to a freezing temperature when it gets beyond the surface. There it will be solidified, and by the coating of crystals formed, help to protect the water within from freezing. It may possibly be that the slight relief from pressure which the water would experience on escaping from constraint when it arrives at the free surface would predispose it to immediate solidification.

A very similar arrangement of crystals of salts of lime may be observed occasionally to exude from plastered walls, strongly confirming the supposition that the water of which the filamentous crystals in the present case are composed comes from within and is not deposited as a form of hoar frost from without.

Harlton, Cambridge, February 20 O. FISHER

I AM astonished at the Duke of Argyll's first letter (NATURE, vol. xxi. p. 274) not having received a more adequate answer from nearer home. The explanation of the phenomenon in question is to be found in the action of capillary attraction (as stated by Mr. King, p. 302), together with the growth of crystals by absorption from surrounding media; in this case from fog and watery vapour in the air.

Comb-shaped masses of ice, of a decidedly fibrous structure, and several inches high, are to be observed here every winter, extending over wide ranges on the loose and porous soil of the wooded hills near Freiburg, especially on inclined path-borders devoid of vegetation. They are found most abundantly when fogs have prevailed for a longer period, with the temperature below freezing-point, as has been the case these last months. These filamentary masses are formed at the same times and from the same causes as the hoar frost on trees, grass, &c., but of course they are much more durable than the latter, being of a much coarser texture, and not exposed to the destructive action of the winds and of the sun's rays. They are, moreover, protected by grains and clusters of soil raised by the growth of the filaments, and sometimes forming a covering sufficient to conceal the icy masses from a superficial inspection, the structure being surprisingly revealed by a stick's stroke.

During the extraordinarily protracted frost-period of last January, a snow-sheet of a few inches only persisted round about here for several weeks. Meanwhile we have had extremely quiet air (with high barometer) and fogs of varying density, only interrupted sometimes by a few hours of sunshine about noon. Now a very remarkable consequence of this state of weather was to be observed, offering, as it were, another proof for the explanation given above. The thin snow-cover served as a soil, from which grew up everywhere the most beautiful and delicate crystalline structures, forming a superimposed stratum, in many places of much greater height than the snow-crust, on which it arose, but, of course, of a very loose cohesion. This, no doubt, is the same phenomenon as that mentioned in the beginning of the Duke of Argyll's first letter, being due, likewise, to the attraction continually exercised by crystals of ice and snow on the watery vapour of the cold air. The crystalline fern-growths in these cases, and the fibrous masses in and upon the porous soil may be considered as equivalent, the condensation of vapour being more abundant, and producing fibrous instead of more delicate crystalline structures, when taking place on and between loose earthy (or wooden) particles.

Undoubtedly such phenomena have been oftentimes observed in many countries. A careful and detailed description (with illustrations) entitled "Ueber Eiskrystalle in lockerem Schutte," has been given by Dr. G. A. Koch in the *Neues Jahrbuch für Mineralogie*, 1877, p. 449, especially considering these structures from a crystallographical point of view.

Freiburg im Breisgau, February 21 D. WETTERHAN

"Scientific Jokes"

WILL Mr. Moulton compassionate my ignorance, and explain to me (and to many others equally uninformed, and equally thirsting for information) *in what sense it is true* that "The energy of heat is made up of heat and temperature." I have been taught that heat is energy. If this be true, the energy of heat cannot depend on temperature.

I would also beg for an explanation of the statement that "Force is the power of producing energy." I have been taught that energy cannot be produced or destroyed by any natural process whatever.

As to the explanation of the earth's magnetism, I should have said that Prof. Rowland was the first to imagine it (as he was the discoverer of the beautiful result on which it is based), but he saw at once its incompatibility with known facts. His trenchant note in the *Philosophical Magazine* for last August, in which he points out "more exactly" Messrs. Ayrton and Perry's error, has not yet (to my knowledge) been answered. And no wonder; for an error of nearly *sixty thousand million per cent.* is not easily got over! G. H.

Tidal Phenomenon in Lake Constance

FOR the second time within 185 years the great sheet of water called the Lake of Constance, the Boden See, or the Suabian Sea, whose superficial area exceeds two hundred square miles, has been frozen over.

In connection with it a very interesting phenomenon has been noticed. At a time when the air was perfectly still and during intense frost the ice broke away in the middle of the lake and came crashing upon that nearer the shore, under which it forced itself or piled itself up in great heaps. An experienced skipper on the lake says there is no doubt that as nearly as possible every twelve hours the great fields of ice move backwards and forwards upon the lake. He adds that both in summer and winter he and his comrades have noticed during an absolute calm a powerful movement in the water, backwards and forwards, sometimes so strong as to require double force to propel the ship. Can any of your readers tell me if this is a true tidal movement?

Another fact which came under my notice to-day may interest your readers. In many places on the frozen surface of the lake and especially near the shore, there are great white spots varying from a foot to two or three yards in diameter. At these spots marsh gas has accumulated under the ice, and upon piercing them and applying a light, a flame will mount up I am told sometimes as high as six feet, though in those in which I experimented to-day it did not rise more than two feet.

SAMUEL JAMES CAPPER

Hotel Helvetia, Kreuzlingen, Switzerland, February 17

Meteors in New Caledonia

DURING the last few nights we have seen numerous flights of small meteors; indeed, so frequent have they been, that they have attracted the notice of the most casual observers. I first observed them on the night of the 9th inst. No fixed direction seems to be followed; in fact, I saw one display such as I have never seen before, which will illustrate my meaning. Two fair-sized meteors proceeded severally from the neighbourhood of Castor and Pollux, and crossed mid-way between those two stars. To me it was a very interesting sight.

A neighbour (a lady) informed me she saw a very fine meteor on the 10th, which left a long trail of light, and burst into shining fragments very like, as she expressed it, "the head of a rocket." The direction pointed out was rather low down in the north-north-west. We have had an unusually long, cool season, which has been quite delightful. Now, for some days past, the heat has set in; the air is charged with electricity; heavy thunder-clouds cling round the mountains in the interior, and frequent lightning-flashes are seen, but no thunder heard. On Saturday, the 13th, heavy rain came up against the wind and drowned out a pretty children's *fête*, the distribution of prizes at the Government Schools; serious colds are prevalent in consequence, your humble servant and his family being in the full tide of fashion, a distinction we could very happily have done without.

E. L. LAYARD

British Consulate, Noumea, December 13, 1879

Intellect in Brutes

MR. THOMSON'S communication in NATURE, vol. xxi. p. 324, has reminded me of an incident which may be of interest to your readers. I have a well-bred and gentle tortoiseshell cat, a feline lady. It is her habit not to steal food from dishes which the family is using; in cold weather, if a dish is placed in the fender to keep warm, its contents are safe from pussy. She has a kitten by no means so refined as herself, one, in fact, that takes after the other parent, a half-wild cat of the gardens. One morning recently the old cat was lying at our breakfast time upon the hearthrug; the kitten was playing about. It was a very cold morning, and a plate of herrings was put into the fender to be kept warm until they were to be eaten. The kitten smelling the fish, stepped gaily forward, with tail erecting itself, towards the fender. An angry growl from the old cat attracted the notice of all in the room, and to my intense amusement and surprise, I saw her strike the kitten a violent blow in the chest, strong enough to overturn the little creature, which retired humiliated to another part of the room.

ALEX. MACKENNAL

Bowden, February 14

A FRIEND in a village in the south of Scotland has a she cat, a great pet in the household. One night, when the lamp was being trimmed, some paraffin was spilled on puss's back, and a short time after, going near the fire, a falling cinder set her in a blaze. In an instant she made for the door (which happened to be open) and sped up the street about 100 yards, and with a tremendous leap plunged headlong into the village watering trough, then stepped out, gave herself a shake, and trotted quietly home. The trough had eight or nine inches of water, and puss was in the habit of seeing the fire put out with water every night.

W. BROWN

Greenock

THE ARTISAN REPORTS ON THE PARIS EXHIBITION OF 1878[1]

THE Society of Arts deserves the thanks of all who are interested in the progress and elevation of our national industries for the manner in which it has attempted to bring home to British manufacturers and artisans the lessons of the Paris Exhibition of 1878. As in 1867, so in 1878, it took a prominent part in the movement for sending over to Paris a number of selected artisans, whose reports on the exhibits of the various departments of industry they represented the Society has now published. Thanks to the interest shown in this step by H.R.H. the Prince of Wales, and by Sir Philip Owen, the artisans sent over by this agency, some two hundred in number, were enabled to visit also a number of the workshops and factories of the French capital, to judge for themselves of the conditions under which the various industries are carried on. The thirty-nine selected Reports printed in the volume before us, form therefore, an extremely interesting and valuable contribution to our knowledge of the relative conditions of the skilled industries in the two countries. The frequent comparisons drawn from the workman's point of view not only upon the quality of workmanship but also upon the conditions and price of labour, the machinery, the tools, and the character of the workmen, are striking and instructive in the extreme.

The Reports range over a wide area of subjects. Porcelain, Earthenware and Glass, head the list with seven separate Reports. Next come Ornamental Ironwork, Wood-carving and Stone-carving. After these are Reports on Machine-Tools, Mechanical Engineering, Agricultural and Horticultural Implements, Bricklaying, Stone-work, Plaster-work, Joinery, Cabinet Making, Clock and Watchmaking, and Jewellery. Optical Instruments have a Report to themselves, followed by others on Machinery for Printing, Spinning and Weaving, on Saddlery and Harness, Shoemaking, and Caoutchouc, whilst the volume closes with a Report on Mining Appliances, and one on Iron and Steel Manufacture.

The topics incidentally touched upon by the artisan reporters are not less wide in their range; they extend from an account of the style of dancing in vogue at the Sunday evening balls in the cafés of Belleville, to a description of a harmony in gold and yellow by Mr. Whistler, which we are told "looks as though the ground had been prepared with a sticky substance, and a shower of gold leaf had been thrown from above." It would be impossible in the space of any mere Review to comment upon all the points of scientific interest raised in these multifarious Reports. To obtain from a perusal of them anything like a connected or accurate view of the relation of science to skilled labour in the systems in vogue in French workshops is almost equally hopeless, since the very different styles of writing and modes of observation of the various writers preclude strict comparisons between one department of industry and another. Nevertheless there are a number of salient features which seem to call for notice.

The Report on Optical Instruments by Mr. M. Lambert,

[1] Published for the Society of Arts, by Sampson Low and Co., London 1879.

of Dublin, speaks of the Telescopes shown by Grubb, Horne and Thornthwaite, and Dallmeyer, as unapproached by any shown by Continental opticians. Mr. Lambert regards the French instruments as a whole, as too lightly constructed to give precision or durability; and though English work errs in the opposite direction, he thinks that a judicious compromise would not only add to elegance of appearance, but would reduce the cost. He adds his opinion that much of the optical work imported into this country might be done as cheaply or more cheaply at home if employers would give the same facilities for working which French operatives have. The French avail themselves largely, it appears, of tools which are not much used for this class of work in England, small planing machines, shaping machines, and rotating cutters. The very fine quality of the brass used in the French Instruments attracted the attention of the reporter.

From Mr. Walker's Report on Machine Tools we learn that Continental engineers are still copyists, though perhaps in some ways in advance of us in the extent to which such appliances are used throughout the industries. The American Section, however, told a very different tale; for here the amount of novelty was almost inconceivable, and the designs had all the freshness of being struck from first principles. The automatic grinding machines of Messrs. Thomson, Sterne, & Co., and the hydraulic plant for boiler building of Messrs. Tweddle called for special comment amongst English exhibits. Mr. Walker points out that we have given too little attention to the necessity which is implied in the employment of machine tools, for skilled workers of a high order; and he thinks that this skill is of a kind which an English workman is better fitted to acquire than a French workman; for the latter has semi-artistic tastes that are not satisfied by machine work. "Let the Frenchman be set to carve a crockett, or to cut a glove, or to shape a meerschaum pipe, or to do any task on which he can claim the result as his own, his soul lightens up." "His own work must be made to appear conspicuously in the result, or his interest in it is gone. This personality in work is not easily attained in the manufacture of heavy machinery."

The first of the Reports on Mechanical Engineering by Mr. J. W. Phillips, speaks of the number of machine-tool makers represented in the French gallery, and of the excellence of their work. Amongst the American machines bearing the stamp of original thought commented upon in this Report, is a screw-making machine of very extraordinary precision and merit. There are a few discrepancies between the three reporters upon Mechanical Engineering, discrepancies which doubtless arise from their visits having been brief and independent. One who expected to find the French artisans deficient in energy, says that "a more earnest and thoroughgoing set of men" he never encountered in a workshop; while another says that "the energy put into their work by the mechanics was certainly much below what we are accustomed to see in England." One mentions tools of novel and superior construction; another sees "very very few tools" that he would think worth introducing into England; while the third says that in machines and tools there is so great a similarity that their nationality would be unrecognisable if it were not for the makers' names on them! One praises the get up of the iron and steel work from the Creuzot works; and while another sees nothing in it worthy of mention, the third speaks of it as a very magnificent contribution, of which any English house might have been proud. All of them comment on the Technical schools, which afford to French engineers in such abundant measure, opportunity to pursue scientific and theoretical courses of instruction. The Report of Mr. Hopps devotes no fewer than five pages to a description of the Municipal School for Apprentices in the Boulevard Villette, the pupils of which institution contributed a very admirable display of specimens of forging, turning, fitting, and carpentry, as well as several larger machine-tools made in the workshops of the school.

The two Reports on Watch and Clock-making, by Mr. Ganney and Mr. Warwick, contain a host of matters of scientific interest, and are well worthy of study. We learn also that, apart from the introduction of labour-saving machinery, the means of production of watches and the forms of the watches themselves are what they were at the beginning of the century; that the Swiss toolmakers annihilated the English watch toolmakers some years ago, and that no English watchmaker has made repeating movements for the last fifty years, the repeating train being imported and fitted to an English going train. Mr. Warwick mentions an American compensating balance in which V-shaped notches filed in a steel rim are filled in with a more expansible brass composition; a device which is probably in every way inferior to the numerous bi-metallic rim-balances with continuous laminæ that have from time to time been devised. He also speaks of certain American watch manufacturers who claim to possess the art of *conferring on springs the property of isochronism* by machines; and adds that as no idea of the machine employed for the purpose was given, "it must be left to individual credulity to form what notion it pleases of this invention." Mr. Warwick mentions with praise the exhibits of the French and Swiss Schools of Horology. Some of these, he says, contained a number of most interesting models of every form of escapement, all mounted with the escapement on the top, so as to facilitate examination; most of them were wound up and going, so that the action could be seen. They were all constructed on a large scale, the balances being four inches in diameter, so that the parts could be well observed and studied. There were working models of escapements on blackboards, with movable parts to show the action and the working angles, which were traced out on the board. "Standing before these objects," he adds, "one could not, as an Englishman, but envy them, and carry his thoughts back to his own land with regret that there are no corresponding institutions for technical education there." Mr. Ganney was even more struck by the advantages possessed by France and Switzerland over our manufacturers in possessing institutions for training workmen of the very highest skill in the theory and practice of their craft. He enters into details about the Horological School of Besançon, its system of instruction, and the extraordinary successes it has achieved. He gives a list of the work turned out by their head pupil, who after being in the school thirty-four months had completed with his own hands nearly fifty watch movements, including a fusee keyless pocket chronometer, and a keyless repeater lever finished and fully jewelled by the pupil. He adds, that as many *years* might have been deemed a reasonable time for learning so much, and that it is doubtful whether the whole English trade contains any English trained workman of experience who could do such a variety of work so well. Self-sufficiency appears to be the characteristic of the English watch trade: with the result that while we turn out less than 150,000 watches a year, America turns out nearly half a million, Switzerland and France some six millions; the French industry having risen in the last thirty years from 40,000 to over a million watches per annum. It appears that good work is as dear in America as here, though a little cheaper in France or Switzerland; but, on the other hand, the Swiss can sell a complete watch in a case, or the Americans a complete watch without a case, for very little more than is charged for an unfinished English blank movement alone; and this solely on account of the labour-saving appliances which they employ.

The other Reports, particularly those on Caoutchouc, on Ornamental Ironwork, and on the Porcelain and Glass

Manufactures, are well worthy of attention, but as they deal with the artistic rather than with the scientific aspect of those industries, we cannot dwell upon them.

Amongst the instructions handed to each artisan reporter at the outset, were suggestions to ascertain the prices and cost of production, the relative amount of machinery employed in production, the hours of labour and the manner of living of the French artisans. Much useful information has been collected on most of these heads. Almost all the reports agree that while cost of living is perhaps a little cheaper in Paris than in London, wages are on the whole much lower; so that it is only by working longer hours and by thrift and steadiness that the French workman can live. The remark is almost universally made that drunkenness is extremely rare; while the absence of almost everything that constitutes home life is equally conspicuous in the habits of the Parisian workman.

In one or two points the volume before us is, from the nature of things, strangely defective. Almost all the reporters who mention the subject at all, appear to have misapprehended the nature and status of the *Cercles ouvrières* or *Corporations ouvrières*, which are the nearest approach in France to the Trades Unions of this country, and the comparisons drawn between the two are in consequence often irrelevant or incorrect. These bodies in France cannot legally extend beyond the limits of the "commune" or parish; they are usually semi-political or socialistic in character, and while they concern themselves with the conditions of labour, are not exclusively occupied in matters of wages and hours of work, and do not, from the local restriction on their operations, exercise an influence in any measure comparable to that exercised by the English Unions over the price or conditions of labour. Again it is impossible to derive from the reports any ideas upon the relation between skilled labour and the educational systems in operation in Paris or in the provinces of France, for the simple reason that not one of the reporters appears to have been made acquainted with those educational systems as a whole. A few of the more prominent technical schools, the *École d'Apprentis*, the *Horological Schools*, and the *Typographic School* of MM. Chaix and Co., are indeed mentioned; but beyond these exceptional institutions and a chance reference to the free evening schools of drawing and modelling which are to be found in every quarter of Paris, there is no reference to the educational systems of the country or to their influence on the artisan, the foreman, and the employer. Any account of the conditions of the skilled industries in France which leaves these out of consideration must be regarded as imperfect in the extreme.

One result is however unmistakable. The artisans who drew up these reports were fully alive to all the advantages of which accrue to an industry from the extension of labour-saving appliances, and from the dissemination of higher technical knowledge. They have faithfully pointed out those departments of industry in which we excel, and those in which we are excelled. They have in most cases stated their opinions as to the causes which have brought about these results. It will be our own fault if we do not strengthen the weak points and fill the gaps now revealed to us. The strides made by some of our foreign competitors are so great as to leave us no margin for indolence or wastefulness on our part. The less favoured nation may more than make up for the material disadvantage of having to import raw products and fuel by the superior thrift and the better training of its workmen. All these things point to the need at home to lose no opportunity of pushing forward the scientific and artistic culture of the workers and of their employers, so that their training may at least be not inferior to that of their Continental rivals.

SILVANUS P. THOMPSON

HOW TO COLOUR A MAP WITH FOUR COLOURS

SINCE the publication in the *American Journal of Pure and Applied Mathematics*, vol. ii. part 3, of the solution of this problem obtained by me, and referred to in NATURE, vol. xx. p. 275, I have succeeded in obtaining the following simple solution in which mathematical formulæ are conspicuous by their absence. It may be premised that the problem is to show how the districts of a map may be coloured with four colours, so that no two districts which have a common boundary or boundaries shall be of the same colour. The object of this colouring being to make the division of the map into districts clear without reference to boundary lines, which may be confused with rivers, &c., it is obvious that nothing will be lost if districts which are remote from each other, or touch only at detached points, are coloured the same colour.

The only parts of the map that it is necessary to consider are the districts, boundaries, and points of concourse, *i.e.*, points at which boundaries terminate. Two districts may have a single common boundary, or they may have two or more such boundaries. Any two districts which have more than one common boundary, inclose one or more groups of districts; in any one of these groups two districts which have more than one common boundary inclose one or more groups of districts, and so on. Proceeding in this way, we limit the area under consideration more and more at each step, and must finally come either to a group which has no pair of districts which have more than one common boundary, or to a single district having only two boundaries, one in common with each of its two surrounding neighbours. *Thus every map must have at least one pair of adjacent districts which have only one common boundary* (β).

Every boundary is either continuous like a circle, or has two ends which lie at the same or at different points of concourse. Every point of concourse may be called *triple*, *quadruple*, &c., according to the number of *lines* radiating from it. I expressly say *lines* and not *boundaries*, because if two ends of any boundary lie at the same point of concourse two of the lines radiating from the latter will belong to only one boundary. If a boundary whose ends lie at two different points of concourse be rubbed out, the number of lines radiating from each of those points of concourse will be reduced by one, thus if the two points were each triple points, they will become double points, *i.e.*, they will no longer be points of concourse, the two remaining lines which radiate from each becoming one boundary. The result is that rubbing out a single boundary *may* reduce the number (B) of boundaries in the map by three. It can, however, never cause a greater reduction, and may cause a smaller, *e.g.*, rubbing out a continuous boundary, or one which ends in two quadruple points reduces the number of boundaries by one only.

Now the obliteration of the boundary β causes the two districts it separates to become one, thus reducing the number of districts (D) in the map by one, and the map still remains a map, and has therefore a pair of districts having only one common boundary. Obliterate this common boundary, and so on. We finally get a blank sheet, *i.e.* a single district and no boundary, and each reduction of D by one cannot involve a reduction of B by more than three; thus 3D must be greater than B, consequently 6D must be greater than 2B; but 2B is the number which would be arrived at if we counted both sides of every boundary, *i.e.*, the number which would be arrived at if we counted the number of boundaries to each district and added them all together; thus the number arrived at by the latter computation must be less than 6D, *i.e.*, it is impossible that every district can have as many as six boundaries, *i.e.*, *every map contains at least one district with less than six boundaries.*

We can therefore reduce a map to a single district by successive operations of throwing two districts into one by rubbing out the boundary or boundaries between two districts of which one has less than six boundaries. Conversely we can develop a map, starting from a single district and adding boundaries, at each stage dividing a district into two, one of which has less than six boundaries. Suppose at any stage of its development by this process a map can be coloured with four colours [red, blue, green, and yellow]. Let these colours be indicated by coloured wafers placed on the districts. Proceed to the next operation, this divides a wafered district into two districts. Shift its wafer on to the district of these two which is not the one which has less than six boundaries: if both have less than six boundaries shift the wafer on to either. If the district (W) which is left without a wafer is only touched by three colours it can be coloured the fourth, and a wafer may be put on it representing that colour. But if it is touched by all four colours we must take another step. This can only be necessary if W has four or five adjacent districts. These may either all surround or all be surrounded by or some surround and some be surrounded by it. Take first the case in which *four* districts are adjacent, all surrounding or surrounded by W. Let *a b c d* be the districts, taking them in the order in which they stand. Let *a* be red, *b* blue, *c* green, and *d* yellow. If, starting from *a*, we can get to *c*, going only through red and green districts, and not passing through any points of concourse, we cannot, starting from *b*, get to *d*, going similarly only through blue and yellow districts, for otherwise two tracks which pass through different districts would cross. Thus *b* forms one of a group (G) of blue and yellow districts which are cut off from the rest of the map by encircling red and green ones. We can accordingly interchange the blue and yellow wafers in G without changing any others; this makes *b* yellow, and we can put a blue wafer on W. Similarly, if we cannot pass from *a* to *c*, *a* belongs to an isolated group of red and green districts. Interchanging the wafers in these, *a* becomes green, and a red wafer can be put on W. Precisely similar reasoning applies in the case of *five* surrounding or surrounded districts, viz., *e* red, *f* blue, *g* green, *h* blue (two must of course be the same colour), and *k* yellow. Here either *e* belongs to an isolated group of red and green districts, or *k* to one of yellow and green districts, or *f* to one of blue and yellow, and *h* to one of blue and red districts. In the first case, interchanging wafers as before, *e* becomes green, and a red wafer can be put on W; in the second *k* becomes green, and a yellow wafer can be put on W; in the third *f* becomes yellow, and *h* red, and a blue wafer can be put on W. In all cases before putting the wafer on W we can interchange the colours of districts, *e.g.*, we can put red wafers in the place of all the green ones and *vice versâ*. Thus we can make the three colours adjacent to W any three we please. If therefore the districts adjacent to W belong to different groups of districts surrounding and surrounded by W, and so detached from each other, we can rearrange the wafers in each group so that only three colours in all shall be adjacent to W, which can therefore have a wafer of the fourth colour placed on it. Thus in any case the district W can be wafered with a wafer of one of the four colours. Thus if the map can be coloured as developed at any stage it can be coloured at the next. Hence since it can obviously be coloured at the first stage when there is only one district, it can be coloured at the last.

Take then two copies, P and Q, of the map we wish to colour, one of which, Q, is on a slate or in pencil, so that the boundaries can easily be obliterated. Pick out a district with less than six boundaries. Rub out in Q the boundary or boundaries (if there be more than one) between this and any other district which is adjacent to it. Number with a (1) the corresponding boundary or boundaries in P. Repeat the operation, numbering the boundary or boundaries in P this time (2). Continue the process until a map is arrived at which can obviously be coloured with four colours. This will generally happen long before we reduce the number of districts to four. Put wafers on the middle of the districts of Q, representing the colours. Proceeding as before shown with the process of adding boundaries in the order indicated by the numbering of P taken backwards, and of shifting the wafers so as to be able to add a wafer to the W of each stage, we finally arrive at a stage when Q is in its original state. The map can then be coloured as indicated by the colours of the wafers.

This method applies equally to maps drawn on the surface of globes, but fails in the case of surfaces which are not necessarily divided into two parts by an endless line, these in general requiring more than four colours.

A. B. KEMPE

THE LIPARI ISLANDS

ON inquiring in Rome for the Stato Maggiore map of the Lipari Islands, I was told that it was out of print, and when afterwards I succeeded in getting one in Florence, I found that owing to the large scale, the islands from Vulcano to Stromboli, in a north-easterly direction, and from Vulcano to Alicudi, to the north-west, were given on three separate sheets, too unwieldy to use for practical purposes, except in their disconnected form. Our own Admiralty chart (scale $\frac{1}{100000}$) constructed from the maps of a French hydrographer, M. Darondeau, gives all the islands, save Ustica, at one view, accompanied by soundings, and a general diagrammatic view of the principal group. The Comitato Geologico of Rome has not yet published a geological map of the islands, and the only complete one that exists, as far as I know, is that to be found in the antiquated "Vulkanen-Atlas" of N. C. von Leonhard, which is taken from the survey of Fr. Hoffmann. In this map Alicudi, Felicudi, Salina, and the major part of Lipari are represented as composed of tuff with porphyritic lava. Panaria, with the surrounding islets Dattolo, Lisia Bianca, &c., is stated to consist entirely of trachyte. The greater part of Vulcano, and about half Stromboli are given as old felspathic lava, while the craters of Vulcano, Vulcanello, and Stromboli are described as *nochfortdauernde vulk. Bildungen.* Pumice and obsidian are shown in various parts of Lipari.

Since Admiral Smyth visited the Æolian Island in 1815, numerous observers have followed in his footsteps. He has devoted thirty pages of a quarto volume on "Sicily and its Islands" to this subject, and two of the three Admiralty charts which relate to these islands, contain engravings executed from his drawings.

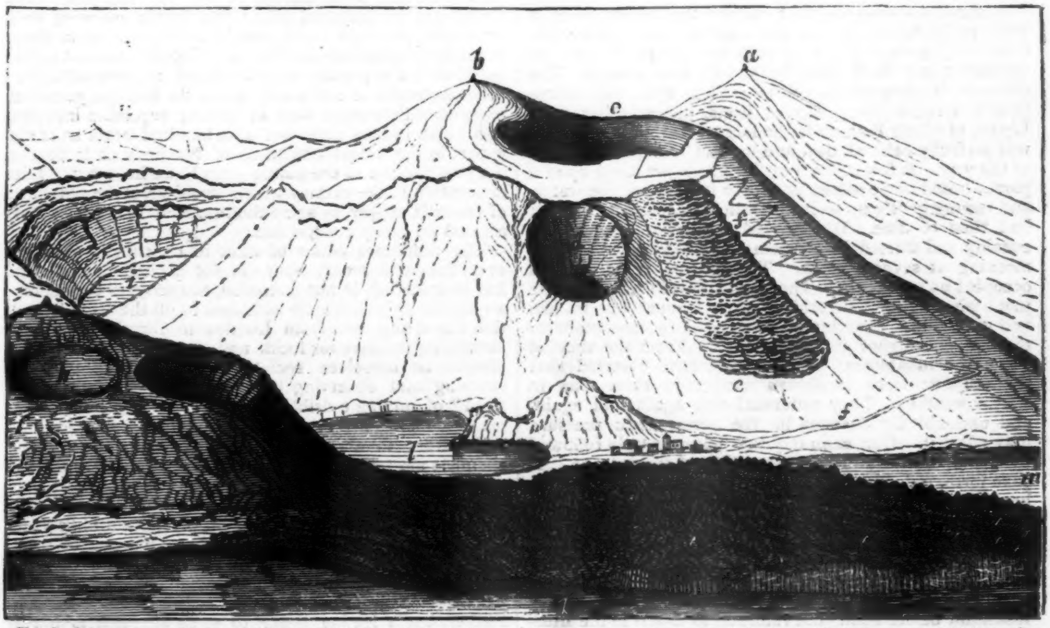
In 1874 Prof. J. W. Judd visited the islands, and he has embodied the results of his observations in some valuable memoirs contributed to the *Geological Magazine*, accompanied by reproductions of drawings made on the spot. To him we are indebted for the accompanying view of Vulcano and Vulcanello.

We were surprised at the complete ignorance manifested both by the Romans and the Neapolitans, in regard to everything connected with Lipari and the members of its group. Everybody said "You must tell us all about them when you come back." In fact the islands are very little visited; communication with the mainland is at the best only twice a week; the boats are small and inconvenient, and they start at midnight; and worse than all, the most important island of the group (Lipari) is cursed by the presence of some 400 convicts, who are sent to this penal settlement, much as we sent ill-disposed persons to Botany Bay forty years ago. We left the harbour of Messina at midnight, having on board ten of these manacled *manutengoli*, guarded by carabinieri. At six the next morning we were off Lipari, and soon afterwards

anchored opposite the castle. The town, although fairly clean and flourishing, affords wretched accommodation to the traveller. We lived almost entirely on hard boiled eggs and sweet *malvasia* wine; even fish, butter, and milk could only be obtained at uncertain intervals, and breakfast had to be delayed because no bread was baked. It reminded me, indeed, forcibly of some of the out-of-the-way towns on the flanks of Aetna, such as Aderno, Randazzo, and Bronte.

Lipari is about ten and a half square miles in area. The highest point is 1,978 feet above the sea. Everywhere the island betrays its volcanic origin. Tuff, pumice, liparite (quartz-trachyte), and obsidian, are constantly met with; at San Calogero a hot spring (198° F.) pours forth water charged with carbonic acid and sulphuretted hydrogen, while the Bagno Secco discharges steam, sulphurous acid, and (it is said, but I think the statement requires confirmation) hydrochloric acid. The latter is rarely evolved from fumeroles disconnected with an active volcanic vent, as in the present case.

Vulcano is undoubtedly the most interesting member of the group from a volcanic point of view. It lies between four and five miles to the south of Lipari, and contains a semi-active crater, which, as regards its usual dynamic activity, occupies a mean position between Vesuvius in its present state of action, and an actual solfatara like that of Puzzuoli. We landed at the Porto di Levante (*l*), and at once made our way to the house of the manager of the chemical works near the Faraglioni (*g*). The greater part of the island, including the crater, has lately been bought by a Scotch firm, and chemical works have been established near the base of the crater. The manager's house is the only house on the island; the workmen live in caves in the sides of the Faraglioni, and usually go to Lipari on Sundays to hear Mass and to see their friends.



Sketch of the great central cone of Vulcano, with Vulcanello in the foreground. *a a*, outer crater-rings, culminating in Monte Saraceno; *b*, highest point of central cone; *c*, great crater; *d*, small crater, called the *Fossa Antica*; *e*, obsidian lava-stream of 1775; *ff*, road leading into the crater; *g*, the Faraglioni, with the chemical works near it; *h*, Vulcanello, showing two of its craters: *i*, the Atrio between the outer crater-rings and the central cone; *k*, the lava-stream proceeding from Vulcanello; *l*, Porto di Levante; *m*, Porto di Ponente. (Taken by permission of Prof. J. W. Judd and Dr. Henry Woodward, from the *Geological Magazine*, December, vol. ii.)

Sulphur, alum, and boracic acid are the substances procured from the crater. We noticed also sublimates of sulphide of arsenic, and salts of copper were found in association with some of the aluminous incrustations; also chloride of ammonium. I have been assured by two eye-witnesses that blue and green flames sometimes issue from clefts in the bottom of the crater. The former would of course be due to burning sulphur; might not the latter owe their colour to the boracic acid?

Prof. A. Cossa (*Gazetta Chimica Italiana*, 1878, p. 235-246) has pointed out that Vulcano furnishes the richest supply known of cæsium and rubidium. The Faraglioni, also called *rocca dell' alume*, is a trachytic mass much decomposed by sulphurous and sulphuric acids; potassium-alum is found in its cavities, associated with the sulphates of aluminium and calcium, with chloride of ammonium, and with the alums of thallium, cæsium, and rubidium. Iron and copper compounds are also found in small quantities in the incrustations, also the sulphides of selenium and arsenicum, and traces of sulphate of lithium. The most complex mixture of volcanic products hitherto found was discovered by Cossa on the edges of a small fumerole at the bottom of the crater of Vulcano. It was found to consist of the sulphides of arsenic and selenium, chloride of ammonium, boracic acid, sulphate of lithium, together with cæsium- and thallium-alums, and traces of the alums of potassium and rubidium. To the south-west of the Faraglioni there is a well containing about half a metre of water through which bubbles of gas are continually and rapidly rising. C. Sainte Claire Deville calls this *la Grotta del Cane dell' isola di Vulcano*. The gas analysed by Cossa was found to consist of 80 per cent. of carbonic anhydride, 19·4 of nitrogen, and 0·6 of oxygen. The temperature of the water is 22° C.

We ascended the crater of Vulcano by the zigzag path *ff*, and on arriving at the summit we found beneath us a very regularly formed crater (*c*), which is nearly one-third

of a mile in diameter, and from four to six hundred feet in depth. For many years it has ceased to emit lava, but so recently as 1874 several large fissures opened in the floor and sides, and from them stones of considerable size, ashes, and vast volumes of vapours were emitted. The descent into the crater is easily effected. We found steam issuing at high pressure from several orifices in the floor, around which crystals of sulphur and other products of sublimation had collected. On the south-west side of the crater, about twenty feet from its floor, we saw a large opening apparently going down a considerable depth into the heart of the mountain. From it loud surging noises proceeded, as if much-agitated lava existed within it, but no lava could be seen, and the air which proceeded from it was so fearfully hot that it was impossible to approach within many feet. At the orifice itself I believe it would have readily melted lead. Hot sand and blue and green flames are frequently emitted from this bocca.

A small fisherman's boat carries the letters twice a week to Stromboli, but as the weather was particularly fine, we determined not to wait for it, and started on January 5 in a small open boat, with four rowers. The distance is about twenty-three miles, and the course passes between the group of islets, eleven miles from Lipari, of which Panaria is the largest member. The sea was perfectly calm all day, and we had to row every inch of the way. A few miles from Stromboli we came upon a parrot-billed turtle asleep upon the surface of the water, and rowing gently up to it, the sailors secured it before it had time to dive. We arrived somewhat late in the evening and started for the summit (3,090 feet) the next morning at seven o'clock. The ascent is steep, and occupied us two hours. The great conical shadow of the mountain was seen stretching many leagues out to sea, and gradually approaching the base of the mountain as the sun got higher in the heavens. From the time of Pliny the inhabitants of Stromboli have asserted that the eruptive force is always weaker in calm than in stormy weather. They reiterated this again and again, and undoubtedly changes in the atmospheric pressure may effect it. Our calm day was unfortunately followed by a comparatively inactive condition of the volcano. It gave forth, indeed, enormous quantities of steam, but red-hot ashes were only ejected at long intervals of time, and never to a height exceeding 200 feet, and the sight at the summit of the mountain was altogether less interesting than that presented by Vesuvius even in its condition of *piccolo eruzione* a year ago. We descended rapidly over steep beds of fine volcanic ash, reached the base of the mountain before noon, and returned to Lipari in the afternoon. Some days later while steaming from Messina to Naples, we passed within sight of the crater of Stromboli, which was obviously in a state of increased activity.

G. F. RODWELL

SOMETHING ABOUT MILK

A SPECULATOR upon the possible fluctuations of that inscrutable phase of human attribute which we know as "fashion" or "custom" might find material for a lucubration of no small interest in a forecast of probable results, supposing the influence exercised by it on many of our largest branches of trade were to extend itself to certain others which appear thus far to have escaped it, and are therefore more or less unprepared to encounter one of its eccentric revolutions.

And yet in an age when the successive crazes for novelty are certainly as rampant as ever they were among the *haut-monde* of the ultra-æsthetic Greek metropolis, it is hardly safe to reckon upon the endurance of any purely customary feature of life merely on the strength of its universality or even its long standing. Probably not one man in a thousand takes the trouble to realise to himself the degree in which many of our most indispensable demands are really maintained by conventional habit. And in no instance is this more likely to escape appreciation than in that of the so-called "necessaries," whose "intermittent service" is as much taken for granted as the return of daylight.

The milk-supply of any large centre of population, to be anything like efficient, must rest upon a series of conditions so various, so complicated, and so linked together, that probably no one unacquainted with the details of both the material itself and the machinery of its delivery, has any idea of the extent to which the dislocation of any one of them might entangle the whole. Complex and unstable in its physical constitution to a degree far beyond any other of the "perishables" in hourly requisition, milk of every description is for this very reason in tenfold greater risk of imparting a shock to the foundations of its trade if society should happen to rush into any modification of its conventional uses. Every one is prepared to awaken in the morning to a sense that the world has decreed a new system of coiffure, or set up another Dagon of Form or Colour since last night; but should the popular vote be found to have discarded the teaspoonful of cow's milk which the habit of years has mingled with certain sups of boiling vegetable infusion, and which in fifty cases out of a hundred bears as trivial a part in the actual nutriment of the body as it does in the gratification of the palate—surely we have but a faint conception of the dismay which would greet the reduction of the milk-supply by some thousands of tons daily, from a cause so easily conceivable.

The miniature ocean of milk in consumption during every four-and-twenty hours in the United States alone has approached, if not exceeded, 200,000,000 of gallons; a quantity approximately sufficient to fill the Grand Junction Canal half way from London to Birmingham, with something to spare for locks and evaporation. We may picture to ourselves society stretching itself one dull morning and observing that after all this antiquated "fad" of mixing a driblet of milk with the infusions of tea or coffee is a very curious one—difficult to trace, and still harder to account for. Indeed our doctors and chemists are telling us that many of the choicest qualities of milk are annihilated by contact with a hot liquid, and that in the particular case of tea it is even so far decomposed, or recomposed, that it is absolutely not milk at all that reaches our digestive organs, but a mixture of semi-saponified fats with an entirely new compound of curds and tannin. As a correspondent of one of the food journals has aptly observed, "there may be nothing like leather, but a leather lining to one's stomach is hardly an illustration of the eternal fitness of things.

"The habit is really a culpable waste, and it is time we laid our heads together to blow it up." Then the dairy trade would rise to find its business cut down to one-third of what it was, the demand for milk being suddenly limited to creaming, cookery, and babies, and a vast industry would be upset, until it had perforce adjusted itself to the new requirements.

Upon some few conditions of this order, or rather upon the absence of popular appreciation of them, have grown up several of the standard prejudices on the matter of milk and its value and method of use, which it is often thought impossible to combat, and which therefore it has been the aim of dairies and milk-sellers rather to compromise than to make evident. It is true that science is still but on the threshold of the subtle changes characteristic of all compounds which originate in the action of vitality; and theories "understanded of the people," are not easy of diffusion so far as to bear the fruit of popular common-sense. Yet if it were practicable by a sort of bird's-eye view of the whole question to enforce a general apprehension of a few comparatively simple facts, there is no doubt that both the public and the trade would benefit

by the disappearance of a tribe of erroneous fears, annoyances, and malpractices, which are reciprocally inflicted on both parties. And this with the result that the natural use of fresh milk would commend itself to the world in such a manner as to compensate the hypothetical disorder entailed by any such freak of fashion as above indicated.

Foremost among these easily-defined but little-known facts stands the exceedingly sensitive nature of the material itself, a clear conception of which alone would wipe out many charges against unoffending causes, and prove a natural and inevitable salve for many sore grievances. In the first place it must be distinctly realised that *nearly the whole* of the vast demand made upon milk is, in fact, outside its natural functions; and is, so to speak, *ab initio*, an unfair one. Nature never designed milk for exposure to atmospheric air or variations from its own limits of temperature, its primary purpose being to gently supplement and gradually replace that source of the earliest sustentation which commences from the fountain of life itself. It is scarcely necessary to point out that in the natural process milk is but a transition-compound, evolved directly with the blood, and passed (without delay, exposure, or appreciable change of temperature) from the body of the parent to that of the offspring, there to meet with an immediate assimilation by which the conversion into blood is completed. If practical evidence of this were needed, the chemist and comparative analyst will point with interest to the really very inconsiderable difference both in mechanical and chemical structure which subsists between the two.

Similar also is their behaviour when cooled and exposed to the air, save only that the changes occurring in blood show it to be even more susceptible of chemical alteration than milk.

Have we then much reason in our surprise or complaint when this exquisitely delicate compound occasionally resents the outrageous changes from heat to cold and back again—the hours of ruthless jolting and contact with air of every degree of impurity, which we expect it to sustain with unruffled sweetness of temper?

Rather let us marvel that a confection (for such it really is) which the tenderest care can hardly retain in its pristine perfection, should so often reach our breakfast-tables with the refinement of its true quality so little impaired.

Only of late years have even the commercial authorities practically learned the lessons of purity which some of them have so creditably endeavoured to teach us by concentrating the business within large-scale establishments when time and capital are really devoted to securing the desired care.

Now let us look more closely at one or two of the innate peculiarities of milk, in consequence of which a large amount of grumbling is almost invariably lavished upon the wrong heads. The most pregnant of all these is what we shall call its *effluvium*, that is to say, effluvium in the strict sense, to which nothing offensive *necessarily* attaches.

Every known substance is capable, in a greater or less degree, of both diffusing and imbibing effluvia or vaporous compounds which are often beyond the reach of any chemical estimation. These become known to us, *if at all*, through the sense of smell, and only subsequently by their action on surrounding matters. Probably but few persons outside the scientific world would be prepared to hear that it would be *next to impossible to devise a compound liquid more susceptible to effluvial influences than fresh milk*.

Imbued at its outset with a slight and agreeable effluvium of its own, it possesses every condition of structure favourable to the reception and retention of every volatile matter approaching it. Most persons are aware of the affinity of all oily matters for odoriferous principles of any kind, and to such as are acquainted with the composition of milk, an illustration of daily occurrence cannot seem overdrawn. A can of milk is received into the house in the evening, and according to a tradition, commendable as far as it goes, is at once poured into a clean earthenware jug; there is no cover, perhaps, but the vessel is clean. This is stood, say on a stone shelf in the larder, to keep cool and free from taint. Its companions there are a joint or two of cold meat (in its gravy), a few unfinished tarts and blanc-manges, a large bowl of scrap-bread (with incipient fungoid growth), a couple of dozen of eggs (not *all* fresh), underneath, the cheese; overhead, a jar of onions in pickle; in the near distance a few head of game in an advanced stage of—well, "keeping", and last, but not least, a closed window. Now, what is the "action" hereupon? A thousand to one, the temperature of the milk is, when received, *different* to that of the air in the larder (whether higher or lower). Immediately that it comes to rest, the surface next the air becomes warmed or cooled as the case may be, and by giving place to other portions, sets up a series of gentle currents, by means of which every part of the fluid is successively brought into contact with the air, and its countless crowds of butter-corpuscles, containing fatty matter in a high state of sub-division, are enabled to expose the greatest possible extent of surface. Now it is scarcely the fault of that milk if in ten hours' time it has failed to lay by at least a trace of every shade of effluvium which has had a chance of circulating near it. And yet when the pardonable nastiness of the milk is commented upon at breakfast, there will not be found wanting some one to exclaim, "What *can* those people feed their cows on?"

Is it necessary to follow the case further? into the nursery or sleeping-room, for example, where the half-breathed air, kept in active movement by the human lungs, and laden with suspended moisture condensing carbonic acid from every direction, heightens even further still the conditions of contamination, while the temperature is such as to place the unfortunate milk upon the very tenter-hooks of absorptiveness. Indeed, one must repeat that a plan could scarcely be devised, short of actually pouring in acetic acid, to communicate the taint of sourness with such absolute certainty and rapidity.

In every grievance, therefore, that arises on the score of *bad or tainted* milk, let us at least learn to distrust the *last* place it has been in rather than the *first;* and ask ourselves whether it is not possible that a substance which has already gone so far out of its way to serve us may not have been finally "put upon" in a manner for which our own end of the transaction is alone responsible. Let it be borne in mind that our own care of the milk we purchase is *more important* than that which precedes it, for two obvious reasons—first, that we receive it at a late period of its life, when it has already suffered from previous ill-usage, and is therefore more susceptible of injury; and secondly, that we receive it in *small quantities*, and thereby expose a proportionately larger surface to contamination.

The other chief point upon which general prejudice is still much astray is that of modern adulteration. There is no doubt that within the last ten years that which was the rule in this respect has become the exception, and it is a high satisfaction to be able to say that in London especially there is even less cause for present uneasiness on the score of tampering with milk than is popularly supposed. The system of supervision and the simplicity of tests have really driven the ancient mysteries of "Bob" and "Simpson" into a remote corner, and Annatto stands forth in the daylight with an easy conscience.

Pure milk, and not only pure but *clean* milk, can be obtained with certainty at current prices, and when this is the case it will take no long period to obliterate the common fallacy which still clings to the idea that yellow milk must be rich, white milk chalky, and blue milk

watered. Annatto openly accomplishes the first, nature has no occasion to be ashamed of the second, nor an exhausted cow of the third.

There is reason to hope the time is not far off when it may be said of town milk-supplies that if we will only do our part in taking care of the pence, the pounds may safely be trusted to take care of themselves. And if we have no justification for the comparatively hard service still required of milk, we may at least allow it a precedent dating from a time even earlier than that at which any land can have "flowed with milk and honey."

ARTIFICIAL PRODUCTION OF DIAMONDS

GLASGOW seems determined to have the honour of producing the diamond artificially. In spite of Mr. Mactear's recent failure, Mr. J. B. Hannay, whose paper on the solubility of solids in gases we published not long ago, has been utilising the method indicated in that paper in experiments on the artificial production of the diamond. Mr. Hannay reads a paper on the subject at the Royal Society to-night, and any remarks on his work we shall postpone for the present. Meantime from the letters and articles that have appeared in the papers, we may form some idea of what has been done. Prof. Story Maskelyne, writing to the *Times*, says:—

"A few weeks since I had to proclaim the failure of one attempt to produce the diamond in a chemical laboratory. To-day I ask a little space in one of your columns in order to announce the entire success of such an attempt by another Glasgow gentleman. That gentleman is Mr. J. Ballantine Hannay, of Woodbourne, Helensburgh, and Sword Street, Glasgow, a Fellow of the Chemical Society of London, who has to-day sent me some small crystallised particles presenting exactly the appearance of fragments of a broken diamond. In lustre, in a certain lamellar structure on the surfaces of cleavage, in refractive power, they accorded so closely with that mineral that it seemed hardly rash to proclaim them even at first sight to be diamond. And they satisfy the characteristic tests of that substance. Like the diamond, they are nearly inert in polarised light, and their hardness is such that they easily scored deep grooves in a polished surface of sapphire, which the diamond alone can do. I was able to measure the angle between the cleavage faces of one of them, notwithstanding that the image from one face was too incomplete for a very accurate result. But the mean of the angles so measured on the goniometer was 70 deg. 29 min., the correct angle on a crystal of the diamond being 70 deg. 31·7 min. Finally one of the particles, ignited on a foil of platinum, glowed and gradually disappeared exactly as mineral diamond would do. There is no doubt whatever that Mr. Hannay has succeeded in solving this problem and removing from the science of chemistry an opprobrium so long adhering to it; for, whereas the larger part of the great volume recording the triumphs of that science is occupied by the chemistry of carbon, this element has never been crystallised by man till Mr. Hannay achieved the triumph which I have the pleasure of recording to-day. His process for effecting this transmutation, hardly less momentous to the arts than to the possessors of a wealth of jewellery, is on the eve of being announced to the Royal Society."

The *Glasgow Herald*, in referring to Mr. Hannay's discovery, states in a general way that his process "involves the simultaneous application of enormous pressure—probably many tons on the square inch of surface within the apparatus—and a very high temperature, ranging up to a dull red heat. It may be said that the process is the outcome of a thoroughly scientific investigation into the subject of solution, and not a 'happy-go-lucky' hit. We understand that hydrocarbon compounds have been used in the process, but we have some hesitation in concluding that the crystalline carbon is of necessity obtained by the dissociation of those compounds; by and by, however, that point will doubtless be satisfactorily established. So far as we can learn, Mr. Hannay's experiments were not all successful, there being, it is said, far more failures than successes; the latter, however, occurred near the end of the series, thus showing that the operator had become familiar with the conditions under which the dissociation of the carbon was effected, and its subsequent deposition in the crystalline form. It would seem that up to the present only very small crystalline particles have been obtained, and hence the process must be an exceedingly expensive one to produce a real gem; something like spending 5*l.* to get 5*s.*, to speak roughly."

Prof. Roscoe, writing to the *Times*, states that the use of his name as having accepted Mr. Hannay's discovery as an accomplished fact has not been authorised by him, and that the evidence yet submitted to him by Mr. Hannay is insufficient, in his opinion, to establish so important a conclusion.

THE HISTORY OF WRITING[1]

II.

THE new alphabet eventually made its way from the Delta to the old home of the Phœnicians on the coast of Palestine. Already in the time of David the Syrians had their historians and state annals, and Hiram of Tyre, we are told, wrote letters to King Solomon. The Phœnician alphabet, as we may now call it, was communicated to the Israelites along with other elements of culture, and the neighbouring populations of Edom, of Ammon, and of Moab received it at the same time. Names had already been given to the letters, derived from Phœnician words which began with the several letters of the alphabet, *a*, for instance, being called *aleph*, "an ox," *b*, *bêth*, "a house," and so on. In this way the meaning of each letter was the more easily impressed upon the memory of the Phœnician schoolboy, just as in our own nurseries it used to be thought that we should have less difficulty in learning our alphabet if we were taught that "A was an archer who shot at a frog," than if we were simply told that A was A. Names and letters alike were imported into the countries that adjoined Phœnicia, and in course of time inscriptions in the new characters were engraved upon stone, as well as painted on the more perishable materials of papyrus or bark. The earliest monument of the Phœnician alphabet that has come down to us is the famous Moabite Stone, discovered a few years ago on the site of Dibon, which records the conquests and buildings of King Mesha, the contemporary of Ahab. The forms assumed by the characters upon this stone must have been the same as those employed by the Jewish prophets when writing down their prophecies or recording the history of their times.

Meanwhile the northern neighbours of the Phœnicians, who lived on the shores of the Gulf of Antioch, had been venturing on trading voyages into the far west and carrying with them a knowledge of the alphabet along with the wares and pottery of the East. They had found the inhabitants of Asia Minor and the adjacent islands in possession of a syllabary, the origin of which is still a puzzle, but as they pushed further westward into the islands of the Ægean and the harbours of Greece, they discovered a people wholly illiterate and unacquainted even with the rudiments of picture-writing. Amongst this people whom we now term Greeks, they soon established colonies, the most important being at Thebes, and in the islands of Melos and Thera. The island of Thera was probably the first spot on European soil where words were translated into written symbols. The earliest Greek inscriptions, it is believed by competent authorities, belong to Thera, and

[1] Lecture at the London Institution, February 12, by Prof. A. H. Sayce. Continued from p. 380.

the alphabet of these inscriptions is the oldest alphabet of which we know. The forms of the characters in it bear so close a resemblance to those on the Moabite Stone as to justify us in concluding that the parent-alphabet from which those of Thera and of Moab were both derived, was the same, and that the date of the inscriptions of Thera was not far distant from that of the inscription of King Mesha. In this case the alphabet would have been introduced into Greece in the ninth century B.C.

The Greeks themselves believed that the old Phœnician colony in Bœotian Thebes was the source and centre from which the alphabet was spread throughout the country. Kadmus, "the Eastern," for such is the meaning of his name, was its mythical inventor, though later legends told how the crafty Palamedes and the poet Simonides subsequently added fresh letters. But these legends are all the fables of the literary age; the kernel of truth they contain is the fact that the Greek alphabet came from Phœnicia. It is a fact, indeed, to which the word *alphabet* itself still bears witness; *alphabet*, or *alpha*, *beta*, the two first letters of the alphabet, are both, as we have seen, Phœnician words.

It would be tedious and unnecessary to follow out the fortunes of the alphabet when once it had made good its settlement on European soil. The forms, and in some cases the values, of the characters gradually changed, and many of them underwent particular modifications in different parts of the Greek world. A little practice enables us at once to determine, by merely looking at the forms of the letters, to what special branch of the Greek race an inscription belongs.

Like the Phœnicians before them, the Greeks repaid the benefit they had received by handing on their alphabet to nations still further west. The Greek colonies in Sicily and Southern Italy being mostly of Doric descent, brought with them the Doric alphabet, and accordingly the natives of Southern Italy, when they first began to write, used the Doric alphabet of their Greek neighbours. Hence it is that the Latins and ourselves after them attach a tail to the letter *R*, which was wanting in the old alphabet of Phœnicia; hence, too, we have inherited from the Romans the letter Q, which had been lost in all the Greek alphabets except that of Dorian origin. On the other hand, the Etruscans, that mysterious people of Northern Italy, who exercised so profound an influence upon the infant civilisation of Rome, learnt the art of moulding and decorating vases from the potters of Athens, and since the latter were in the habit of inscribing the names of the gods and heroes they depicted above the representations of them the Etruscans learnt at the same time the Old Attic or Ionic alphabet. We need only place the alphabets of Etruria and Athens side by side to be convinced of this fact. *R*, for instance, is represented in both by the tailless P, we look in vain in both for a Q, and the two distinct symbols that once stood for the gutturals *c* and *k* are amalgamated into one. Alphabets, like words, if rightly questioned, can be made to tell their own history as well as that of the people who employed them.

The alphabets of Western Europe are the lineal descendants of that of Rome. Our capital letters are identical with those inscribed on the monuments of the Eternal City, and we can trace by the help of contemporaneous documents the successive changes which have transformed these capitals into the smaller type of the printing-press or the letters of our running-hand. Thus A became A, a, *a* on the one side, and a, a on the other, while *b* and b can be followed back to B through the intermediate stages B, b, b, b, and *b*.

But in borrowing or deriving an alphabet from another people one great difficulty has always to be encountered. The pronunciation of no two peoples is exactly the same, nay, generally speaking, it differs very widely. Consequently the sounds attached by the one people to the letters of their alphabet will not in all cases agree with those attached to the same letters by the other. It will often happen, moreover, that sounds will be wanting in one language which are common in another. In borrowing an alphabet, therefore, it will be necessary to do more than simply transfer it; it must be adapted just as the pronunciation of French words like *Paris* or *Marseilles* has been adapted to the genius of English pronunciation. New sounds have to be given to the old letters, new letters have to be invented or formed out of old ones, while some of the old letters may be dropped altogether. It is not often, however, that an alphabet has been adopted and adapted in so scientific a manner as to make it express even approximately all the varieties of sound peculiar to the language of the borrowers. Generally speaking, the adaptation has been of a rough-and-ready kind, and those who use it have been contented if the words they utter are made fairly intelligible when written in it. Often, too, the alphabet has not been consciously and deliberately introduced among an illiterate people or a race which has hitherto employed a different mode of writing. Most of our West-European alphabets have gradually grown into what they are through the slowly-working force of time and circumstances and the successive attempts of individuals to improve them. We cannot say, for instance, with any real truth, that our English alphabet has been borrowed and adapted in the same sense in which it has itself been borrowed and adapted for representing the sounds of a Polynesian dialect. From the time that it was first introduced into these islands under the form of the so-called Anglo-Saxon alphabet it has had a continuous history, a history of slow and sometimes almost imperceptible change and development, which, if allowed to have gone on without check and hindrance, would have resulted in a tolerably serviceable instrument for representing and recording our words. But unfortunately its natural development was suddenly checked nearly 400 years ago by the invention of printing. The necessities of the printing-press stereotyped the alphabet and spelling of the time with all their imperfections, and, what is more, stereotyped the pronunciation of words which that spelling endeavoured to symbolise. It was in vain that a healthy spirit of independence long continued to prevail among that large section of educated Englishmen who were neither printers, authors, nor schoolmasters, and that as late as the end of the last century it was considered no disgrace for a cultivated member of the aristocracy to spell in any way he might think fit. We have only to examine the original manuscripts left by some of the most distinguished Englishmen of the eighteenth century to discover that they were still able to assert the liberty of private spelling against the tyranny of the printing-press.

For a language and its pronunciation must change from generation to generation in spite of all the efforts of printers and pedants to put them into a straight waistcoat. We have only to use our ears to perceive that the pronunciation of cultivated English is even at the present moment slowly but surely undergoing alteration. I wonder how many here this evening still cling like myself to the old pronunciation of *either* and *neither*, and have not yet passed over to the ever-multiplying camp of those who change the pure vowel of the first syllable into a diphthong, or agree with the poet-laurate in accenting *contemplate* and *retinue* after the fashion of our grandfathers? So long as a language lives it *must* grow and change like a living organism, and until this fact is recognised by our schoolmasters, our boys will never realise the true nature of the language they speak and the grammar they learn in childhood. The change that has passed over the pronunciation of English since the days of Shakspeare is greater than can be easily conceived. Were he to come to life again among us, the English that we speak would

be almost as unintelligible to him as an Australian jargon, in spite of the fact that our vocabulary and grammar differ but slightly from his. But a familiar word sounds strangely when its pronunciation is altered ever so little, and when the outward form of a whole group of words is thus changed, the most skilled philologist would find himself at fault.

Can anything, therefore, be more absurd than an endeavour to mummify an extinct phase of pronunciation, especially when the mummy-shroud was at its best but a rude and inadequate covering which pourtrayed but faintly and distantly the features of the corpse beneath? English spelling has become a mere series of arbitrary enigmas, an enshrinement of the wild guesses and etymologies of a pre-scientific age and the hap-hazard caprice of ignorant printers. It is good for little else but to disguise our language, to hinder education, and to suggest false etymologies. We spell, we know not why, except that it is so ordained in dictionaries. When Voltaire was told that *a-g-u-e* was pronounced *ague*, and *p-l-a-g-u-e plague*, he said he wished the *ague* would take one-half the English language and the *plague* the other half; but the fault lay not with the English language, but with English spelling.

Ignorance is the cause of our bad spelling as it is the cause of most of the mischiefs which afflict the world. The brief sketch of the history of writing we have been studying to-night has shown us the goal at which writing should aim, the end in which the labours of previous generations should find their fulfilment. Writing should represent clearly, tersely, and as nearly as possible the individual sounds of words, and unless it does this it has not advanced much beyond those infantile stages of growth through which we have watched it struggling to pass. The principal sounds of a language should each have a special symbol set apart to denote them, and each symbol should denote one sound, and one sound only. We ought never to hesitate for a moment over the pronunciation of a proper name or a word we have never heard pronounced. Until we have an alphabet which fulfils these conditions, our system of writing is still imperfect and misleading, and our civilisation on this side is less advanced than that of the ancient Hindus. We may well envy the rude races of the Pacific or Southern America, for whom the missionaries have provided adequate and rational alphabets in which to write their first essays in literature. An alphabet which allows us to express the sound of *e* in thirteen different ways, which has no special symbols for such common sounds as *th* in *then* or *a* in *man*, and yet possesses otiose and needless letters like *c* and *x* is unworthy of its name, and still more of being the final result of all that toil and thought which first worked out the Phœnician alphabet and then fitted it to express the idioms of Athens and Rome. We are sometimes told that to reform our alphabet would destroy the etymologies of our words. Ignorance, again, is the cause of so rash a statement. The science of etymology deals with sounds, not with letters, and no true etymology is possible where we do not know the exact way in which words are pronounced. The whole science of comparative philology is based on the assumption that the ancient Hindus and Greeks and Romans and Goths spelt pretty nearly as they pronounced, in other words were the happy possessors of real alphabets. It lies with ourselves to determine whether we, too, shall be equally happy. The spread of education which we are witnessing, and the general interest taken in it, afford an exceptionally favourable opportunity for breaking the yoke of bondage in which the printers have kept us. If our board-schools are to be tied down to the particular mode of spelling advocated by Walker or some other maker of unscientific dictionaries, the opportunity will have been lost, and the yoke of bondage will be bound more tightly round the necks of our children than it is even round our own. I know the practical difficulties that lie in the way of reform, but I know also that they are not insurmountable. Too often the difficulty is but an excuse for our own lazy disinclination to go to school again and learn to read English in a new way. But it is not by laziness, by shrinking from trouble and exertion, that England has gained the place it now holds among the nations of the world, and the value of a thing is measured by the labour it demands to achieve it. After all, the introduction of a new alphabet is not much to ask for. It is no more than was asked for and obtained by the old Phœnicians of the Delta, by the Greeks, by the Romans, nay, by our own ancestors also. And many of them, too, had to give up their cherished idols before they could accept it; I fancy it must have cost the Anglo-Saxon cutter of runes as hard a struggle to adopt the new-fangled alphabet of the Roman missionaries as it may cost some of us to give up the alphabet of the printers for one which would fitly express our own splendid inheritance of speech. But let there be no mistake upon the matter; it is not a reformed spelling, as is often erroneously and injudiciously said, but a reformed alphabet that is required. We cannot work to good purpose with imperfect and worn-out instruments. High farming needs steam-ploughs, and not the primitive instrument of the Egyptian peasant. If the history of writing has taught us anything, it is that writing is perfectible, and that what was done in old days by those whose civilisation we are apt to consider inferior to our own can be done also by ourselves.

NOTES

AT the anniversary meeting of the Geological Society on Friday the Wollaston medal was assigned to M. A. Daubrée, of Paris, and the Wollaston fund to Mr. Thomas Davis, of the British Museum. The Murchison medal and fund were presented to Mr. R. Etheridge, F.R.S., Palæontologist to Her Majesty's Geological Survey and the School of Mines; the Lyell medal to Mr. J. Evans, LL.D., F.R.S.; and the Lyell fund to Prof. Quenstedt, of Tübingen, on whose behalf it was acknowledged by Prof. H. G. Seeley, F.R.S.

M. HERVÉ-MANGON has been appointed director of the Paris Conservatoire des Arts et Métiers, in succession to General Morin.

MM. ANTOINE BREGUET, son of the celebrated member of the Institute, and Richet have taken the joint direction of the *Revue Scientifique*, the largest and most influential French scientific periodical. M. Antoine Breguet will write more specially on physics, and M. Richet on chemistry. It is understood that M. Alglave, the former editor, has resigned in order to devote himself more entirely to the propagation of Spencerism and Monism.

M. LŒWY, sub-director of the Observatory of Paris, is conducting very delicate researches for determining the different flexions arising from the weight of meridian instruments when they are pointed in any other position than the zenith. The study of these small differences is conducted on a new principle invented by M. Lœwy. A biconcave lens has been placed in the central part of the instrument, and arranged so that an image of the spider-thread can be placed in coincidence with the threads in a certain position. In moving the instrument the coincidence is destroyed, and can be re-established by the micrometer. The image of the threads can be seen (1) with the eyepiece reflected on the edges of the lens illuminated through the axis by a lamp placed as usual, (2) by the anterior part of the lens illuminated by a lamp placed in front of the eyepiece, (3) by a reflection on the object-glass. The sensibility of the process is so extraordinary that a difference was found when a weight of ten kilogs. was suspended at each end of the instru-

ment, whose total weight exceeds a ton. These experiments are conducted by M. Lœwy at the meridian telescope which is used for small planet observations from full moon to new moon. During that time the instrument is not employed, observations being made at Greenwich according to the co-operation established by Leverrier and Sir George Airy twenty years ago.

IT has been remarked by Admiral Mouchez that the number of small planets observed at Greenwich last year did not reach the twentieth part of that observed at Paris. A member of the Institute has derived from this fact the inference that, irrespective of the differences of weather produced by the difference of situation, the view must have been clearer as a whole during the waning moon than during the other part of its revolution. The suggestion is worth being tested by direct observation, and is one of the most obvious instances where the advantages of connecting astronomical observations with meteorology, so much advocated by Leverrier, may be illustrated.

THE building of the Nice Observatory established by M. Bischofsheim, is progressing favourably. M. Perrotin, one of the astronomers of the Paris Observatory, has been appointed director, and will leave for Nice as soon as the state of the works may require his presence in this magnificent establishment.

IT is proposed to establish a meteorological and magnetical observatory on the Island of Réunion.

THE wide-spread and daily-increasing applications of electricity have caused the formation in Berlin of an "Electrotechnischer Verein." Its establishment is in a great measure due to the energetic German Postmaster-General Stephan, whose lively interest in the latest advances of science we have already had occasion to notice. The officers include, besides Herr Stephan, such well known names as Prof. Kirchhoff and Dr. Werner Siemens. The membership already numbers over 700, and embraces prominent representatives from all departments of science and art.

IT being now twenty-one years since the Geologists' Association was established, the event is to be marked by a social meeting of the members at St. James's Restaurant on Thursday, March 4, at 6.30 P.M.

THE already large number of periodicals devoted to chemistry in the German language is increased by the appearance in Vienna of the *Monatshefte für Chemie und verwandte Theile anderer Wissenschaften*. This new journal will contain all the chemical memoirs presented to the Imperial Academy of Sciences, whither with but rare exceptions, the results of chemical research in Austria are forwarded for publication. By its rapid publication it is intended to meet a want felt by Austrian chemists, whose patience is tested by the slow appearance of their investigations in the *Sitzungsberichte* of the Academy, a lapse of four or five months often intervening between presentation and publication. There is perhaps also a tribute to the national pride in possessing finally, like their *confrères* in Russia and Italy, their own chemical journal, and ceasing to be dependent on French and German periodicals for bringing the results of their work before the great mass of chemists. The *Monatshefte* will appear ten times during the year, and form a volume of about 800 pages. In the first number, which was issued in January, there are articles by Weidel and Herzig, on Derivatives from Bone Tar; by Hönig, on a New Isomeride of Gluconic Acid; by Exner, on the Theory of Inconstant Galvanic Batteries; by Herth, on the Synthesis of Diguanide, &c.

AT the annual public *séance* of the Belgian Academy on December 16, 1879, interesting discourses were delivered by Baron de Selys Longchamps, on the classification of birds since Linnæus, and by M. Gilkinet on the development of the vegetable kingdom in geological times (see *Bulletin*, No. 12). A report was presented on the work of the Academy in the mathematical and physical sciences during the last five years, the jury awarding the quinquennial prize to M. Houzeau, for his "Uranometrie générale." The Academy having several years offered a prize for researches on torsion, has, last year for the first time, received a memoir on the subject, which receives honourable mention, but is not thought worthy of the prize. The deaths recorded during the year have been those of one member, Chappuis, and three associates, Dove, von Lamont, and Gervais.

HAVING made numerous observations of the enigmatical red spot of Jupiter, M. Niesten finds (Belg. Acad. *Bulletin*, No. 12, 1879) the duration of rotation a period of 9 hours 55½ minutes. Comparing past observations of the reappearance of this spot since Cassini's time, he observes that the time elapsing between two successive returns of the spot, seems to be comprised between five and six years, that is to say, that in one revolution of Jupiter, which is 11·86 years, the spot appears to attain twice its maximum intensity, the one when the planet reaches the heliocentric longitude 324°, *i.e.*, when it is about 50° distant from its perihelion (as Maroldi indicates); the other when it reaches the longitude 157°, *i.e.*, when it is near its aphelion. In the return of this "*tache fixe et passagère en même temps*," as Cassini designates it, may we not (the author asks) find the indication of a permanent spot on Jupiter, a spot which reveals itself to the investigations of astronomers, though concealed at certain epochs by an atmosphere more or less thick?

THE philosophical Faculty of Göttingen University have just had occasion to cancel a doctor's diploma granted *in absentia* to a Greek, Demetrius Menagius, who had presented a paper in 1871 on Xenophon's Hellenica, professedly his own, while it was really a copy of one published in Athens in 1858 by A. Kyprianos, the title-page being falsified, and Menagius's name given as the author's.

FROM Prof. Piazzi Smyth's Meteorological Report appended to the last Quarterly Return of the Births, Deaths, and Marriages for Scotland, we take the following interesting remarks:—"Like its two preceding months of this last quarter of 1879, December had an unprecedently high barometric pressure. But, unlike them, it began with a furious blast of low temperature, chiefly in the south of Scotland, so that there no less than five stations chronicled special temperatures actually below zero of Fahrenheit. And when the Botanical Society met in Edinburgh during the beginning of the month, there was rather a fearful account of the much greater degree of cold that the members had been thus far chronicling this December to what they had registered during the terrible December of 1878. But their fears for the future were needless; the solar phenomenon of sun-spot activity had already passed its lowest point; the low temperatures measured were chiefly confined to the south-eastern divisions; and a warm period set in so decidedly, and generally, over the whole country towards the end of the month, that the mean temperature of the whole of December, 1879, though lower than the mean of all former years, yet has proved 4° higher than that of December, 1878; and together with this so-far improved feature of temperature, the month shows less humidity, less number of rainy days, less rainfall, less cloud, a little more sunshine, but stronger wind, and now chiefly from the west. Territorially, the lowest mean temperatures were not on the hill-tops, but at moderate elevations and in the south, so that there Thirlestane Castle recorded 29°·2, and Stobo Castle 30°·2; while in the extreme north Scourie recorded so much as 42°·8, and Sandwich 40°·2—a memorable inversion of ordinary latitude effect. Rain was most abundant in the north-west and north, so that there Dunvegan measured 6·71 inches, Stornoway 5·72 inches, and Scourie 5·30 inches; while in the south-eastern, East Linton measured only 0·50 inch, and Smeaton 0·52 inch. A few lightnings and rather more auroras were seen, chiefly in the north."

FROM an interesting paper in a recent number of the *Revue Scientifique*, on "Fire and Water in Paris," we learn that fire claims a larger number of victims in London than in any other large city in Europe. The lowest percentage of those who meet their death by fire is in Munich, where the percentage is ·4 per 100,000 inhabitants; in Glasgow it is 1·7, in Berlin 2, in Paris 2·4, Naples 4·1, Hanover 5·7, Cologne 7·1, and London 8·3.

IT is stated that Prince Ouroussoff, Russian Secretary of State, is engaged on a scheme for introducing the Gregorian Calendar into Russia.

SIGNOR DENZA, of the Moncalieri Observatory, points out the coincidence of a shock of earthquake in Lombardy and Piedmont on the 9th inst. with the great activity of Etna the same day, and an eruption of a volcano in St. Domingo.

DETAILS are now to hand regarding the earthquake at Carlsruhe on January 24 last. The phenomenon consisted of a very slight shock followed immediately by a more intense one. It occurred at 7.47 p.m. The direction was from west to east. In many parts of the Palatinate an earthquake was observed on the same date about 6.45 p.m. It lasted for seven or eight seconds and was accompanied by loud subterranean noise, ending with a dull explosion. Its direction was from south-west to north-east. Another shock occurred on January 25 at 3.35 a.m. Further earthquakes are reported from Nevesinje (Bosnia), where a violent shock occurred on January 27 at 4.30 p.m., and from San Salvador, where an earthquake did serious damage in the capital on January 10.

A FEW years ago Dr. Legoff subjected himself to an operation of transfusion of blood, in order to save the life of a wounded soldier lying in Val de Grace Hospital in Paris. The operation was successful, inasmuch as the patient escaped, but the health of the doctor declined. He went to Algiers to recover, but with no avail. We learn from an address by M. Wohl, a Professor to the Lycée, on the occasion of his funeral that he died in the beginning of February.

THE "Ornis" (Society for Ornithology and Bird-culture) of Berlin will hold its biennial exhibition from February 27 to March 2 next. The last exhibition, in the spring of 1878, was a great success. The Society will now give gold, silver, and bronze metals to the most deserving exhibitors. Dr. Karl Russ, of Steglitz, near Berlin, is the president, and requests all breeders of birds and possessors of rare and costly specimens who would like to participate in the exhibition to communicate with him.

M. DREYFUS, of Paris, has just published a second edition of M. W. de Fonvielle's recent work, "Comment le font les Miracles en dehors de l'Église," with a new preface and a number of additions relating to recent events.

A CRAYFISH epidemic has broken out from some unexplained cause in almost all the waters of Alsace-Lorraine. Possibly like most epidemics it may be due to some fungus. The German Government has applied to several eminent zoologists for their opinion, and resolved to prohibit the capture of crayfish in this province for the next three years. A number of female crayfish from the piscicultural establishment at Hüningen are to be imported into the Alsatian waters.

AT a recent meeting of the Berlin Academy of Sciences Prof. Conze spoke on the archæological investigations which are being made at Pergamon, and in which besides himself Engineer Humann and Herren Bohn, Stiller, Raschdorff, Jun., and Lolling took part. The principal interest centred round a magnificent altar which was found close below the highest point of the Pergamon Acropolis. We must refer our readers for details to the *Transactions* of the Academy.

THE Low-Rhenish Antiquarian Society at Xanten are having extensive excavations made outside the Cleve gate of that town, where very large Roman foundations have been discovered, dating from the Colonia Trajana.

THE Sixth Annual Report of the Postal Microscopical Society, for the distribution of microscopical slides by post, gives a favourable impression of the work carried on by the Society, which has now 138 members, distributed over the country. Mr. Alfred Allen, 1, Cambridge Place, Bath, is the secretary.

NATIVE Japanese papers state that arrangements for constructing a railway between the Urouchi coal mines and the Ishigari river in the island of Yezo are progressing, and that an agent of the Colonisation Department will shortly proceed to America to purchase necessary material.

HERR ALBIN KOHN has examined various tumuli near Czekanow, in Poland, in which well-preserved skeletons have been found, exhibiting in point of greater height, convexity of the frontal and the occipital, straightness of the facial line, and other cranial characteristics, a Caucasian rather than a Slave type. Near the Cetynia, an affluent of the Bug, prehistoric graves of similar form to those of Czekanow have been opened, but owing to the want of care of the workmen it was impossible to determine whether, as in the latter, the bodies were ranged on the back, side by side. The Polish chroniclers speak of a nomadic race called Jadjvinges, whose origin was unknown, and who, after ages of aggressive warfare, were only wholly subdued in the thirteenth century; and it is not improbable that in the tumuli of the Cetynia Herr Kohn and his coadjutor, Herr Eichler, may have come upon the representatives of this people.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Macauley; a Water Rail (*Rallus aquaticus*), European, presented by Mr. T. J. Mann; three Black Leopards (*Felis pardus*, var.) from India, three Burrhel Wild Sheep (*Ovis burrhel*) from the Himalayas, a Pig-tailed Monkey (*Macacus nemestrinus*) from Java, deposited; four Common Blue-birds (*Sialia wilsoni*) from North America, a Grey Plover (*Squatarola helvetica*), a Bar-tailed Godwit (*Limosa lapponica*), European, an Ocellated Monitor (*Monitor ocellatus*) from East Africa, purchased.

PHYSICAL NOTES

Two independent sets of observations of the electro-magnetic rotation of the plane of polarisation in gases have recently been made—one by MM. Kundt and Röntgen in Strassburg, the other by M. Henri Becquerel, of Paris. The details of the systematic and elaborate research of the former are given in *Wiedemann's Annalen*. The general result was arrived at, though without sufficient precision to formulate the mathematical law of dependence, that those gases which have the highest indices of refraction possess the greatest rotatory power under magnetic strain. The gases examined—air, oxygen, nitrogen, carbonic oxide, carbonic dioxide, coal-gas, ethylene, and marsh-gas, gave a rotation agreeing in sense with that of the magnetising current. The authors also speculate upon the probability that the plane of polarisation of the atmosphere would be found to be rotated under the influence of terrestrial magnetism, and calculate from their results that a thickness of no less than 253 kilometres of air would be necessary to produce a rotation of 1° in a north-easterly azimuth. M. Becquerel approached the subject from a completely different point of view. Some months ago, when examining the vapour of carbon disulphide, he had found an abnormal apparent difference in its optic rotatory power according to the position of the tube in which it was examined. While studying another matter, however, a flood of light was thrown on this observation. In the endeavour to determine as exactly

as possible the position occupied by the plane of polarisation of the sky with respect to the position of the sun, he designed an instrument by means of which the traces of the plane containing the line of sight and passing through the sun could be compared with those of the plane of polarisation as observed in a Savart polari cope. With this instrument it was soon found that, contrary to what has always been hitherto supposed, these planes do not coincide with one another, but that the angle between them may even exceed 6 degrees. The plane of polarisation is, moreover, always nearer the horizon than the sun, while the angle between the planes presents diurnal maxima and minima, a point of extreme interest. The electro-magnetic rotation of the plane of atmospheric polarisation is distinctly proved by the following observation:—At noon the position of the sun is such as to produce an illumination of the sky symmetrical with respect to the meridian, which ought therefore to coincide with the plane of polarisation; but as a matter of fact the coincidence of the two planes does not occur at noon, but at a later hour, so that the plane of polarisation has obviously been rotated through a certain angle. This rotation corresponds with the results obtained by direct observation by M. Becquerel upon the magnetic rotatory power of air, as regards both the magnitude and the sense of the rotation. The existence of rotatory power in gases is thus confirmed from a most unexpected source.

A SUGGESTION has been made by M. d'Arsonval for the improvement of Planté's secondary batteries. M. Planté employed as electrodes in his secondary cells two sheets of lead immersed in dilute sulphuric acid, which became spongy by use, holding the hydrogen and oxygen liberated at the respective poles in loose combination. The limits of the performance of such cells appear to be fixed by the escape of hydrogen bubbles from the kathode, and by the low conductivity of the film of peroxide of lead formed over the surface of the anode. M. d'Arsonval therefore proposes to obviate the one difficulty by electrolysing a salt of zinc instead of a dilute acid, and the other by increasing the available surface of lead at the anode. For the latter he employs shot heaped about a carbon plate. The liquid is a strong solution of sulphate of zinc. During the charging of the cell, zinc is deposited out of the solution upon the surface of a lead plate, or better, upon a free surface of mercury amalgam, suphuric acid being formed in the solution, which attacks the zinc so soon as the cell is employed to generate a current. Whether this modification is really an improvement upon the form devised by Planté, remains to be seen. An electromotive force of 2·1 volts is claimed for the new cell.

ALBUMIN is employed by M. Regnard in the place of collodion for the purposes of microphotography, and is said to afford perfect freedom from the harshness which appears inseparable from the use of collodion films.

DR. SYDNEY MARSDEN has discovered a substance in which carbon is soluble, and from which it crystallises out partly in graphitoidal, partly in adamantine forms. The adamantine crystals exhibit beautiful octahedral shapes under the microscope, and scratch sapphire readily. There seems every reason, therefore, to regard them as true *diamonds*.

GEOGRAPHICAL NOTES

AT the meeting of the Geographical Society on Monday last, Sir T. Fowell Buxton, after a few explanatory observations, read an account of a visit to the famous Lukuga creek in May, 1879, by Mr. E. C. Hore, of the London Missionary Society's station on Lake Tanganyika. The result of Mr. Hore's trip from Ujiji across the lake is believed to be the vindication of Cameron's theory that the Lukuga creek was the long-sought outlet of Lake Tanganyi a. From the Kiyanja ridge Mr. Hore saw the Lukuga, flowing westwards with a rapid stream, on its way to join the Congo, until it became lost to view among the hills of Kwa, Mekito, and Kalumbi's, in Urua. Mr. Hore, it is well to add, was well qualified for the investigation of this matter, being well acquainted with currents, &c., from his former experience when in the service of the Peninsular and Oriental Steam Navigation Company; he is now surveyor and scientific officer attached to the Mission station at Ujiji. Commander Cameron stated to the meeting at some length the history of Lake Tanganyika, from its discovery by Burton, and gave in detail the various theories regarding its outlet. Dr. Emil Holub followed with an address on the Marutse-Mabunda empire in South Central Africa. This empire is of recent formation out of two peoples, the Marutse and the Mabunda, who inhabit the Zambesi region near the confluence of the Chobe with that river, and have their capital at Sesheke. After a few remarks on their geographical position and the neighbouring tribes, Dr. Holub addressed himself to the ethnographical side of his subject, and gave many interesting particulars respecting the people and their manners and customs. Among their peculiarities, as distinguished from other South African tribes, the more noteworthy are a belief in a supreme being and in a life after death, and the respect and consideration in which women are held.

THE arrangements relating to the reception of Prof. Nordenskjöld in France have been somewhat altered. The celebrated explorer having expressed his determination to accomplish personally the *periplus* of the Mediterranean coasts of Europe, he will proceed, *viâ* Gibraltar, to Havre, where he will be received by a deputation from the Paris Geographical Society, and be conducted to Paris, where he will be magnificently treated. The Municipal Council of Paris has subscribed a sum of 200*l*. to the funds. It is certain that he will land at Lisbon, where the Portuguese Geographical Society is preparing a reception. It is said that the Geographical Society of Algiers will send a requisition to Prof. Nordenskjöld asking him to visit their town, and witness their festive installation. He will not be present at the meeting of the Academy of Sciences on March 1. At a large meeting of the Geographical Society of Rome, on Sunday, its gold medal was conferred upon Prof. Nordenskjöld, who was present along with his staff. Speeches were delivered in praise of the enterprise, and Prof. Nordenskjöld replied briefly in French. King Oscar of Sweden has ordered four gold and forty-six silver medals to be struck for the officers and crew of the expedition.

THE Rev. F. Coillard, of the French Basuto Mission, in company with whom it will be remembered Major Serpa Pinto made his journey from the Zambesi to the Bamangwato country and to the Makarikari, has recently delivered a lecture at Capetown, chiefly on missionary topics. He stated that he had sojourned principally among a tribe known as the Banyai in the neighbourhood of the Zambesi. On his journey thither he had passed through a tribe which was divided into small communities, and led a miserable life owing to the oppression of the Matabele. Mr. Coillard also visited the Matabele country, of which he had but a poor account to give; the climate, he says, is most unhealthy, not only for Europeans but even for the natives.

THE new *Bulletin* of the Antwerp Geographical Society contains a paper by Dr. L. Delgeur, entitled "Les Endiguements de la Néerlande: Lutte des Hollandais contre la Mer," and the text of some interesting letters which the International African Association have received from East Central Africa.

THE *Colonies and India* gives a brief description of the magnificent Tequendama Falls near Santa Fé de Bogota, in the Colombian Republic, and draws attention to the fact that it has been visited by but few English travellers.

As supplementing No. 59 of *Petermann's Mittheilungen*, an abstract of an itinerary in Japan, by Dr. Knipping, is published. The itinerary extended from Kioto by Shimonosura to Tokio, and contains much valuable information on the country traversed. It is accompanied by three maps.

No. 8 of *Globus* describes the journey of Rohlfs and Stecker last summer from Battisal, south of Jalo, in Tripoli, to the oasis of Kufra, which lies about half-way between the western frontier of Egypt and the eastern boundary of Fezzan, and has not before been visited by Europeans. The oasis of Kufra lies between 21° and 24° E. and 26° and 24° S., and is happily described in the map which accompanies the paper as an oasis archipelago. It is represented as a series of regions covered with palms, amid a country of hills and sand dunes.

A STRANGE PHENOMENON

THE following letter from R. E. Harris, Commander A. S. N. Co.'s s.s. *Shahjehan*, dated Calcutta, January 19, appears in the *Calcutta Englishman* of January 21:—

"The most remarkable phenomenon that I have ever seen at sea was seen by myself and officers on the 5th instant between Oyster Reef and Pigeon Island (Malabar coast). At 10 P.M. we were steaming along very comfortably; there was a perfect calm, the water was without a ripple upon it, the sky was cloud-

less, and, there being no moon, the stars shone brightly. The atmosphere was beautifully clear, and the night was one of great quietude. At the above-named hour I went on deck, and at once observed a streak of white matter on the horizon bearing south-south-west. I then went on the bridge and drew the third officer's attention to it. In a few minutes it had assumed the shape of a segment of a circle measuring about 45° in length and several degrees in altitude about its centre. At this time it shone with a peculiar but beautiful milky whiteness, and resembled (only in a huge mass, and greater luminous intensity) the nebulæ sometimes seen in the heavens. We were steaming to the southward, and as the bank of light extended, one of its arms crossed our path. The whole thing appeared so foreign to anything I had ever seen, and so wonderful, that I stopped the ship just on its outskirts, so that I might try to form a true and just conception of what it really was. By this time all the officers and engineers had assembled on deck to witness the scene, and were all equally astonished and interested. Some little time before the first body of light reached the ship I was enabled, with my night glasses, to resolve in a measure what appeared, to the unassisted eye, a huge mass of nebulous matter. I distinctly saw spaces between what again appeared to be waves of light of great lustre. These came rolling on with ever-increasing rapidity till they reached the ship, and in a short time the ship was completely surrounded with one great body of undulating light, which soon extended to the horizon on all sides. On looking into the water it was seen to be studded with patches of faint, luminous, inanimate matter, measuring about two feet in diameter. Although these emitted a certain amount of light, it was most insignificant when compared with the great waves of light that were floating on the surface of the water, and which were at this time converging upon the ship. The waves stood many degrees above the water, like a highly luminous mist, and obscured by their intensity the distant horizon; and as wave succeeded wave in rapid succession, one of the most grand and brilliant, yet solemn, spectacles that one could ever think of was here witnessed. In speaking of waves of light I do not wish to convey the idea that they were mere ripplings, which are sometimes caused by fish passing through a phosphorescent sea, but waves of great length and breadth, or in other words, great bodies of light. If the sea could be converted into a huge mirror and thousands of powerful electric lights were made to throw their rays across it, it would convey no adequate idea of this strange yet grand phenomenon.

"As the waves of light converged upon the ship from all sides they appeared higher than her hull, and looked as if they were about to envelope her, and as they impinged upon her, her sides seemed to collapse and expand.

"Whilst this was going on the ship was perfectly at rest, and the water was like a millpond.

"After about half an hour had elapsed the brilliancy of the light somewhat abated, and there was a great paucity of the faint lustrous patches which I have before referred to, but still the body of light was great, and, if emanating from these patches, was out of all proportion to their number.

"This light I do not think could have been produced without the agency of electro-magnetic currents exercising their exciting influence upon some organic animal or vegetable substance; and one thing I wish to point out is, that whilst the ship was stopped and the light yet some distance away, nothing was discernible in the water, but so soon as the light reached the ship a number of luminous patches presented themselves, and as these were equally as motionless as the ship at the time, it is only natural to assume that they existed, and were actually in our vicinity before the light reached us, only they were not made visible till they became the transmitting media for the electro-magnetic currents. This hypothesis is borne out by the fact that each wave of light in its passage was distinctly seen to pass over them in succession, and as the light gradually became less brilliant, they also became less distinct, and had actually disappeared so soon as the waves of light ceased to exist."

THE NEW HYDROGEN LINES OBSERVED BY PHOTOGRAPHY, THE STAR LINES, AND THE DISSOCIATION OF CALCIUM[1]

IN the month of July, 1879, I published in the Reports of the Royal Berlin Academy of Sciences, some photographs of the spectra of Geissler tubes, filled with rarefied hydrogen. In these photographs are visible, besides the old well-known hydrogen lines, H, α, β, γ, δ, a great many other lines in the violet and ultra-violet at the extreme end, very thin and faint, but of a character very similar to the old well-known hydrogen lines. One of the most intense of these new lines coincided almost exactly with the H line (Fraunhofer) of the sun-spectrum.

I inclined to the idea that these new lines, whose wave-length I published six months ago, were real hydrogen lines, but an objection was made to the effect that the hydrogen employed would not have been quite pure. I will mention here that I got exactly the same lines with hydrogen of different sources.

I have recently repeated my experiments, and filled Geissler tubes with the purest hydrogen, developed by electrolytical decomposition. The photographs of the spectra of these tubes show nearly all the same lines as I have published, and I venture now to declare these new lines to be *real hydrogen* lines, so that this body, besides its four chief lines in the visible spectrum, has certainly five chief lines at least in the ultra-violet part.[1]

The wave-lengths of these new lines, which I have published in the Reports of the Berlin Academy, 1879, p. 590, are as follows:—

3968 bright lines coincident with H (Fraunhofer)
3887 "
3834 fainter lines
3795 "

The fifth line was not very distinct; its wave length, which I have not published till now, is nearly 3770.

I have received NATURE, which contains an abstract of Huggins's highly interesting paper read before the Royal Society on the photographs of the spectra of stars. Huggins gives a list of the wave-lengths of the dark lines he obtained in the ultra-violet part of the spectra of white stars, and I was much astonished to find that they corresponded almost exactly with my hydrogen lines above mentioned. I put here Huggins's and my own numbers together:—

Huggins's star lines in the ultra-violet wave-length.	My hydrogen lines in the ultra-violet wave-length.
3968	3968
3887·5	3887
3834	3834
3795	3795
3767·5	3770

This conformity is so surprising that I venture the conclusion that the *chief lines of the spectra of white stars are hydrogen lines*.

Lockyer, whose admirable investigations I highly esteem, but with whose conclusions I cannot agree, regards the line 3968 (coincident with the calcium line H, Fraunhofer) in the star spectra as a calcium line, and deduces a dissociation of calcium from the fact that the second calcium line K is not visible in the star spectra. My opinion is that the line 3968 in the white star spectra is *not* a calcium, but a *hydrogen line*, and I base this theory on the fact that the well-known hydrogen lines in these spectra are much more intense and thicker than in the sun spectrum. I may point out that this line is not exactly, but very nearly, coincident with H (Fraunhofer); the first is a little less refrangible.

Lockyer supposes that calcium is also dissociated in the sun's atmosphere. He mentions the observation of Prof. Young, who observed the H seventy-five times and the K line only fifty times in the atmosphere of the sun. My opinion is that the so-called inversed H line, if visible without K in the chromosphere, is not the calcium line, but the fifth hydrogen line.

[1] By Dr. H. W. Vogel, from the *Photographic News* of February 20.

[1] I have only five in my photographs, because I worked with glass prism and lenses, which absorb a good deal of the ultra-violet rays.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—In the event—which seems most probable—of the report of the Board of Natural Science Studies being adopted by the Senate, the Natural Sciences Tripos will, in and after 1881, be divided into two parts, each of which will include a practical examination, and will extend over five days. The names of those who have passed the first five days will be alphabetically arranged in three classes, although this part of the examination will be considered to test only the general proficiency of candidates in several branches of science. The subjects will be grouped thus: (1) Chemistry, (2) Physics, (3) Mineralogy, (4)

Geology, (5) Botany, (6) Zoology and Comparative Anatomy, (7) Physiology, (8) Human Anatomy and Physiology.

THE Cambridge Botanic Gardens Syndicate have procured plans for a Curator's House and Syndicate Office, to be placed adjoining and overlooking the entrance from Panton Street to the Gardens. Mr. W. M. Fawcett, the architect, estimates its cost at 620*l.*

A REAL compulsory matriculation examination at entrance is absolutely needed, otherwise those who are endeavouring vigorously to bring about improvements will find their life worn out in elementary teaching and examination. If Senior Wranglers can be spared to examine thousands of arithmetic papers and to lecture upon arithmetic in Cambridge year after year, it can be only because they too tamely continue to do it, finding that the Philistine spirit of modern days provides no better pay for them if they preferred higher work. Either this lecturing is superfluous, or their pupils have never been to a good school till eighteen. Why should any student be entered on the books of a university if he does not know at the least the elementary principles of number and of grammar?

A MEMORIAL is being signed in various parts of the country to the Vice-Chancellor of the University of Cambridge, praying that the Senate will grant to properly qualified women the right of admission to the examinations for University Degrees, and to the Degrees conferred according to the results of such examinations.

OXFORD.—The examiners in the Burdett-Coutts Geological Scholarship have elected Mr. H. N. Ridley, B.A., of Exeter College, to the vacant scholarship.

THE following science scholarships have been awarded, after examination in Chemistry, Physics, and Biology:—Mr. T. H. Walker and Mr. J. H. Makinder, from Epsom College, to Natural Science Studentships at Christ Church; *Proxime*, Mr. G. C. Chambres, from Dulwich College; Mr. Alfred Shackleton, from Bradford Grammar School, to a Natural Science Exhibition at New College.

DR. GLADSTONE, finding that several teachers were unable to obtain admission to the lecture delivered by him in the Board Room of the London School Board in October last, on the Apparatus for Illustrating Object Lessons, has consented to repeat the lecture at the following schools on the dates named:—Westmoreland Road, Walworth, S.E. (near Walworth Road Station), on Tuesday, March 2; Saffron Hill, Cross Street, Farringdon Road, E.C. (near Farringdon Street Station), on Tuesday, March 9. Each lecture will commence at 7.30 o'clock. The apparatus recommended and described by Dr. Gladstone are all of the cheapest and commonest kind, such as a clasp-knife, frame-saw, two tin basins, tobacco-pipe, magnifying glass, &c. Such lectures are well adapted to encourage the teaching of science in schools.

THE report drawn up by M. Paul Bert, acting as referee of the Parliamentary Committee of the French Chamber of Deputies on Primary Instruction, has been published as a separate volume, and is selling largely.

THE new law on the organisation of the Superior Council of Education in France has rendered this body a representative one. Not only the several academies, but also the several faculties have been invested with the right of appointing delegates. The Faculties of Sciences have resolved to send delegates to Paris, in order to hear the *profession de foi* of several candidates, and to interrogate them on their opinion on the different topics ventilated by teaching bodies. This example will be shortly followed by other faculties. M. Gerard, Professor of Philosophy to the Faculties of Nancy, having sent a circular summoning the Faculties des Lettres to send a delegate to Paris, their appointed meeting is to take place at Easter, during the usual holidays.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, February 5.—Wm. Carruthers, F.R.S., vice-president, in the chair.—Mr. Chas. Stewart exhibited and explained a stained microscopic section of the ovary of *Hyacinthus orientalis*, showing the intercellular network in the cells of the ovules. The nuclei before dividing increase in size, and there is a well-defined highly refractile fibrous network which becomes aggregated at opposite sides of the nucleus, forming two star-shaped masses connected by fine fibres; the latter rupture when the stellate masses, becoming rounded, form the nuclei of the two new cells.—Dr. Francis Day presented for inspection examples of Salmonidæ, some of which had been reared under natural and others under unnatural conditions. A *Salmo fontinalis* which had passed its existence in the Westminster Aquarium, had the head preternaturally elongated and a very narrow suboperculum, thus in striking contrast to examples reared from the same batch of imported eggs, and kept in a wild state in Cardiganshire.—Mr. R. Irwin Lynch brought under notice pods of *Acacia homalophylla*, wherein each end was attached by a very long and bright red funicle, which doubly folded on the sides of the seed. The funicle is supposed to be always detached with the seed, and from its brilliant colour to serve as an attraction to birds, and so assist in the dissemination of the plant.—Mr. A. Hammond drew attention to a larva of *Tanypus maculatus*. He mentioned that the coronet and appendages of the thoracic and anal regions had been said to be homologous with the respiratory organs of the larva and pupa of gnats, &c. This he doubted, inasmuch as the former originated from the ventral and not from the dorsal surface, as did the latter, and no trachea of any size could be traced in them. He also stated his opinion that the two oval bodies in the thorax attributed by De Geer to the air reservoirs were more probably salivary glands similar to those previously described by himself in the larva of the crane fly.—Mr. C. B. Clarke then gave an oral *résumé* of the order Commelynaceæ, which order he had lately worked out for De Candolle's "Prodromus." He defined the order by the position of the embryo, as not surrounded by the albumen, but closely applied to the embryostega, which is always remote from the hilum. An important auxiliary character is that the three segments of the calyx are always imbricated, so that one is entirely outside the two others. Mr. Clarke divides the Commelynaceæ into three tribes, as follows:—1. *Pollieæ*, fruit indehiscent; (2) *Commelyneæ*, capsule loculicidal, fertile stamens 3–2; (3) *Tradescantieæ*, capsule loculicidal, fertile stamens 6–5. The author remarked on the character of the two ranked seeds on which the genus *Dichospermum* had been founded, but which character is exhibited in species of various genera. He also alluded to the manifest and important change of colour in the petals of several of the Commelynaceæ (*Aneilema versicolor*, to wit), where from a bright yellow when fresh, they become of a deep blue when dry.—The Secretary afterwards read a paper on the Salmonidæ and other fish introduced into New Zealand waters, by H. M. Brewer, of the Wanganui Acclim. Soc., N.Z. The author herein gave data concerning the British salmon (*S. salar*), Californian salmon (*S. quinnat*), trout (*S. fario*), sea trout (*S. trutta*), American charr (*S. fontinalis*), perch (*Perca fluviatilis*), tench (*Tinca vulgaris*), Prussian carp (*Carassius vulgaris*), cat fish (*Pimelodes catus*), white fish (*Coregonus albus*), and lastly a New Zealand fish called by the natives Upukororo.

Physical Society, February 14.—Annual General Meeting, Prof. W. G. Adams, president, in the chair.—The President read the report for the past year, which showed that the position and prospects of the Society are in every way satisfactory, and that more papers were communicated during last year than on any previous year.—The following list of Council and Officers was elected for the ensuing year, and votes of thanks were given to the President, the Lords of the Committee of Council on Education, and to the Treasurer, Demonstrator, and Secretaries. President: Sir W. Thomson, LL.D., F.R.S. Vice-President (who has filled the office of President): Prof. W. G. Adams, M.A., F.R.S. Vice-Presidents: Prof. R. B. Clifton, Dr. Huggins, Lord Rayleigh, Dr. Spottiswoode. Secretaries: Prof. Reinold, and W. Chandler Roberts, F.R.S. Treasurer: Dr. Atkinson. Demonstrator: Prof. Guthrie; and Members of Council: Captain Abney, Walter Bailey, M.A., J. H. Cotterill, F.R.S., Dr. Warren de la Rue, Major Festing, R.E., Prof. G. C. Foster, Prof. Fuller, Dr. J. Hopkinson, Dr. Shuster, G. Johnstone Stoney, F.R.S. Honorary Member: J. E. R. Clausius.—After this business the meeting resolved itself into an ordinary one, and the following New Members were elected:—Senor Roig y Torres, of Barcelona, Mr. Mollison, Mr. Hare, Mr. J. C. Lewis, Miss Caroline Martineau.—A paper on a quartz and Iceland spar spectroscope, corrected for chromatic aberration was then read by Dr. W. H. Stone; the spectroscope consists of two Iceland spar prisms and a quartz train. It differs in no respect from those ordinarily made, except in the fact that the object glasses of the telescope and collimator are doublets with a positive lens of quartz and a negative of Iceland spar. The latter has a dispersive power so far greater than that of quartz that an approximation to achromatism may be easily obtained.

In a spectrum there is less fear of indistinctness from superposition of images than in a telescope, but a greater amount of focussing is required with unachromatic lenses, insomuch that lines in the field at one time need alteration to obtain distinctness. Moreover it is an obvious advantage to transmit the whole of the rays coming from the collimator as nearly as possible parallel through the intra-objective space and the prisms. The object glasses were made by Mr. Ahreas about four years ago, and sent to Prof. Macleod. They were put aside but have been recently re-mounted, owing to Mr. Cornu having recently published a similar device. A paper on an automatic switch for telephone circuits was then read by Dr. Wynne. The object of the switch was to enable any client of a telephone exchange to communicate with any other through the central office without the need of an assistant at the office. Mr. Varley and Prof. Ayrton criticised the device and the latter thought that the contacts might not be always reliable. Profs. Ayrton and Perry then read a note on their theory of terrestrial magnetism. Prof. Rowland of Baltimore had pointed out an error in their calculation which vitiated their results, and they therefore admitted that the charge statical electricity on the surface of the earth, assumed by them as competent to account for the earth's magnetism, was not sufficient to account for the whole but only a portion of that magnetism. Nevertheless they thought that the changes in the distribution of such a charge due to changes in the condition of the dielectric medium between the earth and the sun, might account for the observed perturbations in the magnetic elements.

Statistical Society, February 17.—Sir Rawson W. Rawson, C.B., in the chair.—The business of the evening was the reading and discussion of a paper by Mr. Thomas A. Welton, on certain changes in the English rates of mortality.

GÖTTINGEN

Royal Academy of Sciences, January 10.—The following among other papers were read:—On some Indo-Germanic, especially Latin and Greek, numerals, by Herr Benfey.—Remarks on some Thracian and Mæsian coins, by Herr Wieseler.—The chronology of Julius Africanus, by Herr Trieber.—Report on the polyclinic for ear diseases, by Dr. Bürkner.

PARIS

Academy of Sciences, February 16.—M. Edm. Becquerel in the chair.—The following papers were read:—Meridian observations of small planets at the Greenwich and Paris observatories during the fourth quarter of 1879, communicated by M. Mouchez.—Determination of the difference of longitude between Paris and Bregenz, by MM. Lœwy and Oppolzer. The difference between Paris Observatory and the station of Pfender on a mountain near Bregenz (which is about the most western point of Austria) was found 0h. 29m. 45·14s. (By Pfender Austria was already connected with Germany, Italy, and Switzerland.) The operations are described.—Studies on persulphuric acid; its formation by electrolysis, by M. Berthelot. He has got liquors containing 123 gr. of the acid (S_2O_7), but this could not be exceeded or easily maintained, the rate of spontaneous decomposition becoming equal to that of formation. The liquor also contained 375 gr. sulphuric acid, and 850 gr. water. For these results, dilute sulphuric acid ($SO_4H + 10 HO$, *e.g.*) is electrolysed in a porous vessel surrounded by a concentric vessel holding the same liquid. The liquids are cooled by water flowing in interior serpentines. The electrodes are large platinum wires projecting 2 or 3 ctm. from glass tubes, and six or nine Bunsens are used. (The electrolytic phenomena are studied). Persulphuric acid left to itself is destroyed gradually and wholly. Agitation, or rise of temperature, promotes decomposition; also diminished dilution.—Note on new derivatives of nicotine, by MM. Cahours and Etard. An isomer of *dipyridine* (*isodipyridine*) is obtained by a certain treatment of *thiotetrapyridine*.—Evolution of inflorescence in the *Gramineæ* (3rd part); order of appearance of the first vessels in *Phleum*, *Cynosurus*, *Poa*, by M. Trécul.—On the divisions of cyclotomic functions, by Prof. Sylvester.—Equations of the small oscillations of an inextensible wire in motion in space, by M. Léauté.—On the linear differential equations with doubly periodic coefficients, by M. Picard.—On the same, by M. Mittag-Leffler.—On the hypergeometric series of two variables and on linear differential equations with partial derivatives, by M. Appell.—On Legendre's law of reciprocity extended to numbers not prime, by M. Genocchi.—On the impossibility of the algebraic relation $X^n + Y^n + Z^n = 0$, by M. Korkine.—On the approximation of circular functions by means of algebraic functions, by M. Laguerre.—On new fringes of interference, by M. Gouy. A collimator, with slit horizontal, and a telescope, are placed in line, and between them a glass trough containing half water, half saline solution, diffusion having been allowed a few minutes. Light being transmitted, a series of fringes appears in the telescope, owing to variation in the index of refraction through diffusion, causing the plane wave to be no longer plane after traversing the trough. M. Gouy proposes to study the progress of diffusion by means of these effects.—On the density of some gases at a high temperature, by M. Crafts. He describes some results with his improved apparatus, having experimented with ammonia, carbonic acid, hydrogen, hydrochloric acid, &c. For the last named a normal density was obtained at the highest temperature of the furnace.—Action of water on fluoride of silicium and fluoride of boron; dissolution of cyanogen in water, by M. Hammerl. Numerical results for the heat liberated are given.—Reproduction of amphigene, by M. Hautefeuille. Vanadate of potash which (as formerly indicated) may replace alkaline tungstates and phosphates in preparation of felspars, furnishes crystals having the form and composition of amphigene whenever the mixture of silica and alumina treated contains a large proportion of alumina. The density of artificial amphigene is 2·47 at 13°, that of amphigene 2·48 (Damour).—On the martite of Brazil, by M. Gorceix. By the hypothesis of alteration of pyrites he explains certain facts of pseudomorphism and filling up, observed in certain metamorphic rocks of the province of Minas; also the disappearance of iron pyrites in auriferous itabirites, where gold has for gangues ordinary or arsenical pyrites.—Experimental researches on the phosphorescence of Lampyris, by M. Jousset de Bellesme. He removed the cephalic ganglions, to abolish all spontaneous phosphorescence, then stimulated electrically. He could always thus produce phosphorescence if oxygen was present. He shows reason for thinking that the phenomenon is a chemical one, but produced in Lampyris only under biological conditions. It is of the same order as muscular contraction, or liberation of electricity by the torpedo, which are doubtless due to chemical combinations effected in protoplasmic matter. The phosphorescent substance is probably gaseous, and phosphoretted hydrogen. The author is led to regard phosphorescence as a general property of protoplasm, consisting in liberation of the gas just named.—Researches on the action of salicylic acid on the respiration, by M. Livon. First retardation, then acceleration, then retardation and stoppage.—The temperature of frozen lakes, by M. Forel. The depths reached by Mr. Buchanan (NATURE, vol. xix. p. 421) were not sufficient to cover the limit of surface cooling, which may descend to 110 m. (Lake of Zurich). The penetration of cold is very gradual and progressive. A layer of ice on Lake Morat was found absolutely to stop the cooling, and the water, under ice forty days, underwent an equalisation of temperature, far, however, from complete uniformity.—Torrential deltas, by M. Desor. These deltas will have to be distinguished more than has hitherto been done from the deltas of great rivers.

CONTENTS

380

half
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dif-
after
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some
some
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the
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n in
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nille.
place
bars,
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gen.
neral
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URE,
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The
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n of
Tor-
dis-
ns of

PAGE
389
391
392
392
393
395
395
396
396
396
397
397
397
397
399
400
402
404
404
406
408
409
409
410
410
411